AUTOMOTIVE INDUSTRIES

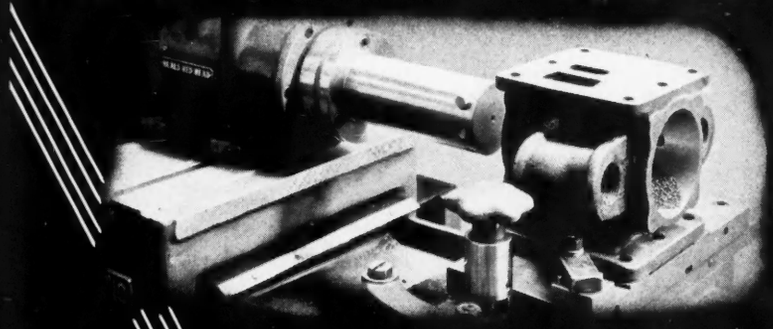
LAND — AIR — WATER

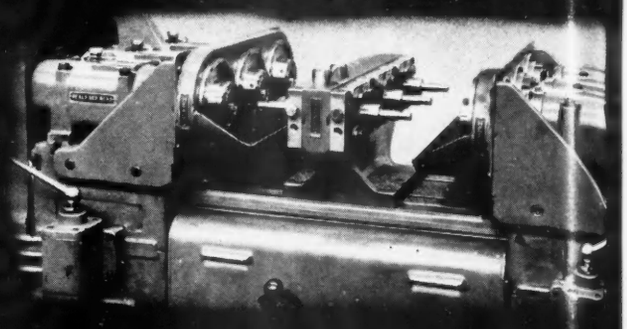
OCTOBER 9, 1937

HEALD Bore-Matics

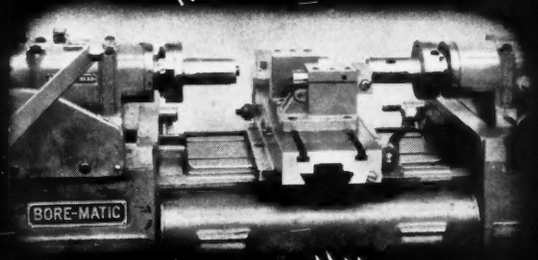
IDEAL FOR ALL KINDS OF OPERATIONS WHEN *Ultra Precision* IS REQUIRED

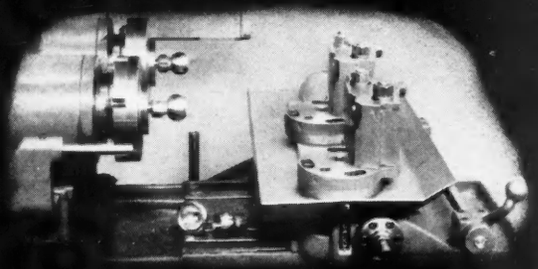
BORING • Large or small — Single or multiple

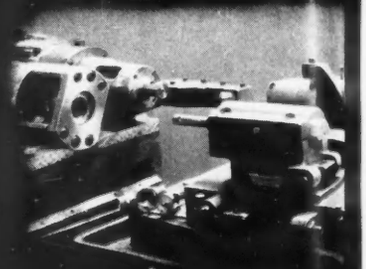




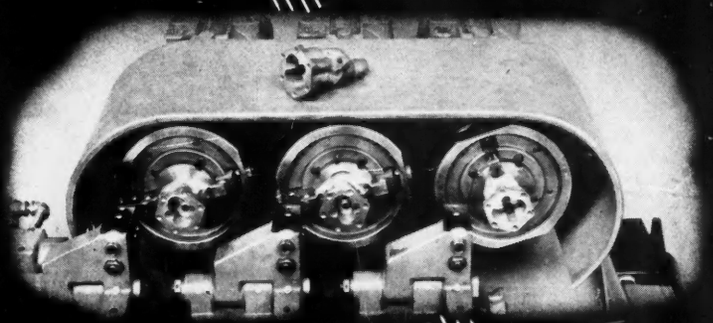
TURNING • Straight — Spherical — Taper

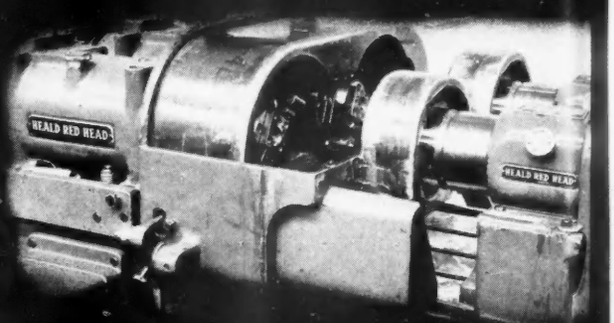






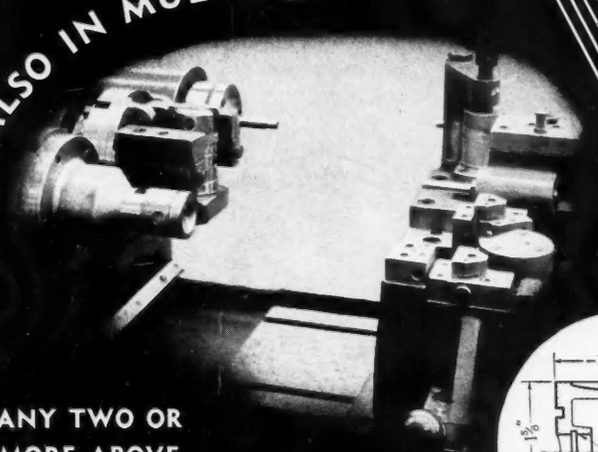
FACING • With Tool — With Grinding Wheel

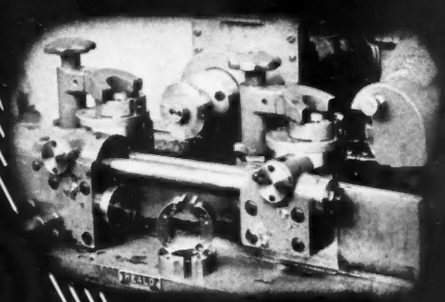


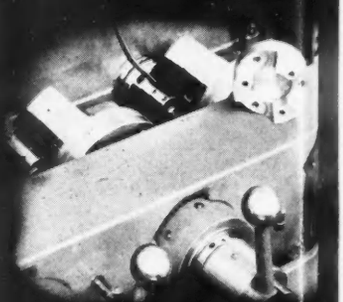


MILLING • Slot — Spot

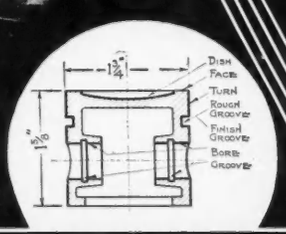
ALSO IN MULTIPLE

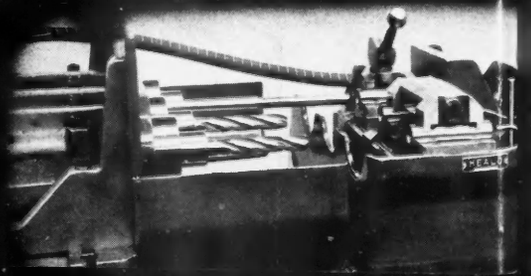






DRILLING • Roughing Before Boring





ANY TWO OR MORE ABOVE MENTIONED OPERATIONS

HEALD MACHINE COMPANY Worcester Mass., U.S.A.

They ALL Agree on SHELBY *for* AUTOMOTIVE PARTS

THE DESIGNER

"I specify SHELBY because it gives me freedom to design. And when I need assistance in laying out a new part, the SHELBY man is right on the job."

THE SHOP MAN

"I like to work with SHELBY because it machines readily. We get fewer rejects with SHELBY. Besides, it's easier on our tools, because it's always uniform."

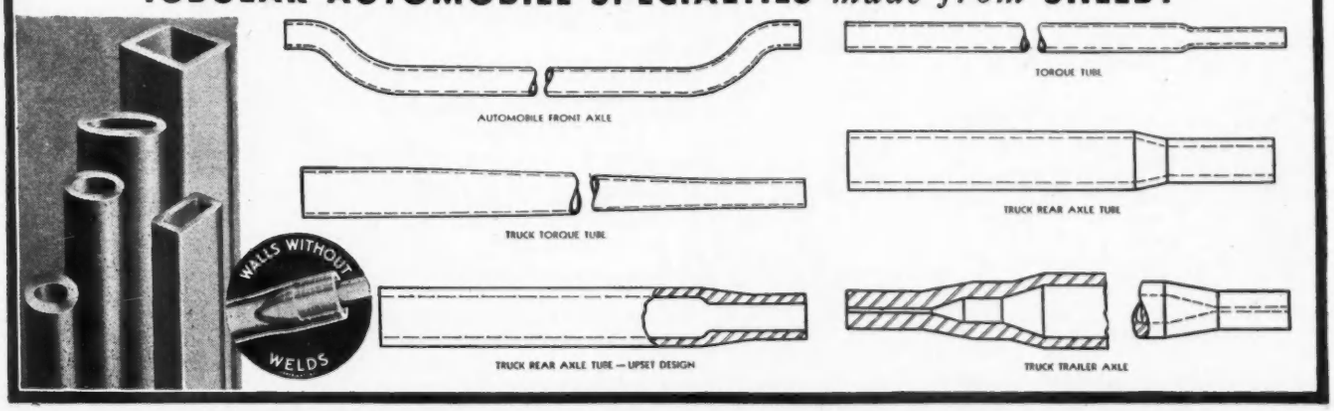
THE PARTS BUYER

"I've found, in buying automotive parts for a number of years, that there's no better indication of overall quality and precision workmanship than the name SHELBY.

AXLES, rear axle housings, steering columns, drag links, tie rods, torque tubes, brake cross shafts, spring shackle bushings for "Knee Action", and seat frames—these are some of the parts leading automobile manufacturers are making from SHELBY Seamless Tubing. They know that only the finest steel tubing has the necessary uniformity to satisfy the requirements of modern mass-production methods. That's why they use SHELBY.

Call the SHELBY Distributor in your vicinity. He carries in stock a wide assortment of tubing—in various shapes, sizes, lengths, wall thicknesses, finishes, and grades of steel. You'll find him a specialist on tubular construction, able to give you valuable aid in the selection and use of mechanical tubing for modern automobile parts.

TUBULAR AUTOMOBILE SPECIALTIES *made from* SHELBY



NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Weekly

Volume 77 — Number 15

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Contents

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AUTOMOTIVE INDUSTRIES

October 9, 1937
Vol. 77, No. 15

SAE Nominates

C. W. Spicer to Head Society For Coming Year

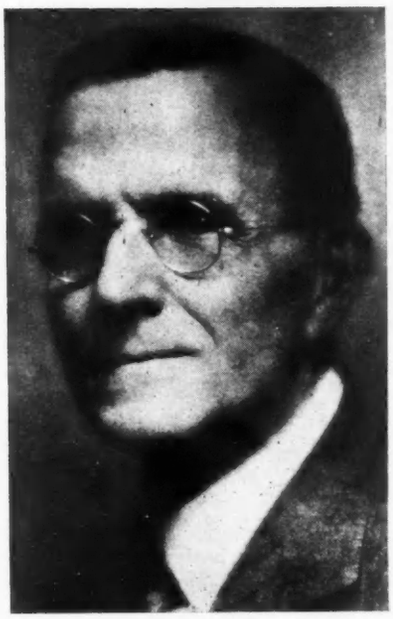
The Society of Automotive Engineers has presented the list of those nominated as officers and members of the Council for 1938.

For president was nominated C. W. Spicer, vice-president of the Spicer Mfg. Corp., Toledo, Ohio. For treasurer the nominee is David Beecroft, manager, New York office, Bendix Products Corp.

Councilors nominated for the term 1938-1939 are W. J. Davidson, general sales manager, Winton Engine Corp.; L. J. Grunder, automotive engineer, Richfield Oil Co. of California and B. J. Lemon, tire engineer, U. S. Rubber Products, Inc. Members of the 1938 Council will also include three men who were elected at the beginning of 1937 for two years terms. They are: A. T. Colwell, vice-president, engineering, Thompson Products, Inc.; W. C. Keys, mechanical products engineer, U. S. Rubber Products, Inc., and J. L. Stewart, general manager, Canadian Automobile Chamber of Commerce. Serving on the 1938 Council as past presidents are to be Ralph R. Teetor, in charge of engineering, Perfect Circle Co., and Harry T. Woolson, executive engineer, Chrysler Corp. and now president of the society.

Nominations for vice-presidents are: aircraft, Frank W. Caldwell, engineering manager, Hamilton Standard Propellers division, United Aircraft Corp.; aircraft-engine, Ralph N. DuBois, experimental engineer, Aviation Mfg. Corp., Lycoming division; Diesel-engine, Carl Behn, Superior Engine division, National Supply Co.; fuels and lubricants, B. E. Sibley, chief technologist, Continental Oil Co.; passenger car, Clyde R. Paton, chief engineer, Packard Motor Car Co.; passenger car body, Frank S. Spring, engineer, Hudson Motor Car Co.; production, E. N. Sawyer, production engineer, Cleveland Tractor Co.; tractor and industrial power equipment, C. E. Frudden, chief engineer, Allis-Chalmers Mfg. Co.; transportation and maintenance, F. L. Faulkner, automotive engineer, manager, automotive department, Armour & Co. and, truck, bus and railcar, H. E. Simi, chief engineer, Twin Coach Co.

Pictures of the nominees will be found on page 472 of this issue.



C. W. SPICER
. . . for SAE President

Asks Ford Election

Brotherhood Files Its Plea With Labor Board

The Ford Brotherhood of America, Inc., has filed application with the National Labor Relations Board for an election at the Rouge plant of the Ford Motor Co. to determine what organization is to represent employees in collective bargaining, according to W. S. McDowell, attorney for the Brotherhood.

The next step, according to McDowell, will be a hearing before the board. Among the witnesses which the brotherhood will ask to be placed on the stand are Henry Ford and P. E. Martin, vice-president in charge of production. "We intend to determine the labor policies of the Ford Motor Co. as well as the membership of other unions in the Ford plant," McDowell declared. "The UAW will be required to expose its membership roll as will also the Liberty Legion, another independent organization of Ford workers."

He said the brotherhood is prepared to produce 2000 cards, each with 10 names of Ford workers, giving also their badge numbers, to back up its claim of 20,000 members in the Ford Rouge plant. The brotherhood has not

(Turn to page 473, please)

Production Soaring

Ford Resumption to Raise Totals for Late Fall

Schedules established by automobile companies for October indicate an output of 350,000 cars and trucks this month, more than double the September volume, and a 50 per cent increase over October last year. The plants are now rapidly shifting into high gear after feeling their way along for a time on their new manufacturing programs. All but Ford and Graham are in production on 1938 models. Ford is expected to get underway on a small scale about the middle of the month, and Graham will follow some time later.

Since Ford's contribution to this month's total will be relatively small, the sharp increase in the industry's total indicates a speedy return to full scale operations by other plants. It suggests also the prospect of another big gain in output next month when Ford plants will be nearing their normal full-time rate and when the balance of the industry will be going at top speed through the entire month. November production could easily pass the half million mark, since the whole new car program is farther along than a year ago when November accounted for 405,799 units.

Last year, when the industry swung into new car manufacture, production jumped 64 per cent from September to October. This year the October increase is closer to 110 per cent over September and virtually assures the industry of maintaining, if not bettering, the 14 per cent lead over 1936 shown for the first nine months. Carried through the balance of the year, the 14 per cent gain would give the final quarter of 1937 an output of 1,316,478 units. The projected output for October will account for nearly 75 per cent of the additional 162,000 units required to be built in the final quarter to maintain the lead shown so far over 1936.

With the production figures of leading companies now available, a closer estimate can be made of the industry's September output which ran somewhat higher than expected. Approximately 167,000 cars and trucks were built last month, an increase of 19 per cent over the 139,820 units turned out in September last year. This brings the third quarter total to 1,028,839 units comparing with 866,960 in the

(Turn to page 477, please)

Oldsmobiles for 1938

NEW STYLING at the front end marks the Oldsmobile six and eight for 1938. Die cast radiator grilles in an altered form are used. That of the six is shown above. At the upper right is an eight cylinder sedan showing the hood and headlight treatment. At the lower right is the detail of the new steering wheel which is supplied with the automatic transmission and the new instrument panel.

Oldsmobile is announcing a six and an eight for 1938, both restyled inside and outside and both now available with, as optional equipment, the automatic transmission introduced on the eight during the summer of 1937.

Designed in the interest of safety is the new instrument panel unit and dash, free of projections and styled in the modern manner. The steering wheel is also of new design and has but one horizontal spoke to permit full vision. A lever which controls the ranges of the automatic transmission is mounted just under the steering wheel.

Exterior style changes occur in the die cast radiator grille which, on the six and eight, is "V-ed" to the bottom. The six grille is assembled of die cast sections while that on the eight is a single large casting. Below the grilles, in both cases, there are slotted louvres. Headlights are mounted low on the crowns of the front fenders and are detachable in case of damage to a fender.

Fenders themselves are of heavier gage sheet metal than before. New hood louvres have been designed with the object of cleaning up body lines and still providing egress for engine heat. This is done by carrying body molding forward and extending it slightly outward from the hood so that the openings are on the under side of the molding extension.

Oldsmobile batteries are carried on the hood ledge next to the engine and are of the end-to-end type, making a long narrow package. The location permits shorter battery cables as well as easier servicing and ventilation through a duct from the front of the engine compartment. Radio aerials are concealed inside the molded rubber running boards which are independently mounted. Headlights are larger.

The automatic transmission, described in AUTOMOTIVE INDUSTRIES May 22 and May 29, permits automatic gear changing within two ranges which include first and second gears, and first, third and fourth. Mechanical details of the Oldsmobile will be found on page 480 of this issue.

New Pierce-Arrow Line

Announce Eights and Twelves On Several Wheelbases

Pierce-Arrow is announcing three groups of cars, an eight on wheelbases of 139 in. and 144 in., a twelve on the same size wheelbases and a larger twelve on a 147-in. wheelbase. Standard and custom bodies are available.

The cars have a modern form of the fender headlights used since 1914 and, to improve illumination, two special lamps mounted between the fenders and radiator shell are provided.

Special attention has been given passenger comfort through the use of costly upholstering and provision for sample space within the bodies.

Both series of twelves have the same engine, a V-type of 3½-in. bore by 4-in. stroke, rated at 185 hp. at 3400 r.p.m. The eight-cylinder engine has a 3½-in. bore and 5-in. stroke and is rated at 150 hp. at 3400 r.p.m. Compression ratios are 6.4 to 1 in each case. Both the eight and the twelve-cylinder engines have aluminum cylinder heads and are mounted on four rubber biscuits. Hydraulic valve-lifters are retained.

PIERCE-ARROW sedan body style for 1938. The cars will be available in several wheelbases and are powered with an eight and a twelve cylinder engine. Particular attention has been paid to the comfort and safety of the passengers. Luggage compartments are made large and in some cases house the spare wheel.

All models carry an improved overdrive which cuts in at between 40 and 45 m.p.h. and reduces the engine speed ratio from 4.58 to 1 to 3.29 to 1. In an additional effort to improve operating characteristics springs are made very long and spring suspensions cover from 73.5 to 77.75 per cent of the total wheelbase, while rear seats are mounted ahead of the rear axle. Hypoid rear axles are used in all models.

Worker Health Gains

Heacock Tells of Procedure Used at Caterpillar

The placement of men in plant jobs which suit them, through the use of pre-employment examinations, is one of the things which employers can do, and have been doing, to reduce the toll of occupational disease, stated B. C. Heacock, president of the Caterpillar Tractor Co., addressing a symposium dinner recently, sponsored by the Medical School of Northwestern University, at Chicago.

Not only does this procedure aid in preventing many an illness, but similar examinations are used by the Caterpillar company to determine whether men return to work too quickly after illness, he said.

Mr. Heacock said he thought that far greater good can come from broad study and individual determination to protect the health of the workman than can come from written law, but voiced the hope that the Illinois law affecting the Peoria plant of the company will work well.

One of the factors involving worker health is wages, permitting a worker, if they are sufficient, to enjoy healthful surroundings outside the plant. Mr. Heacock said that plants today are healthier than many other places where much time is spent and that many workmen contract diseases elsewhere and then complain of improper working conditions when the manifestations appear.

Plant Notes

Expansion Plans Continue To Be Decided Upon

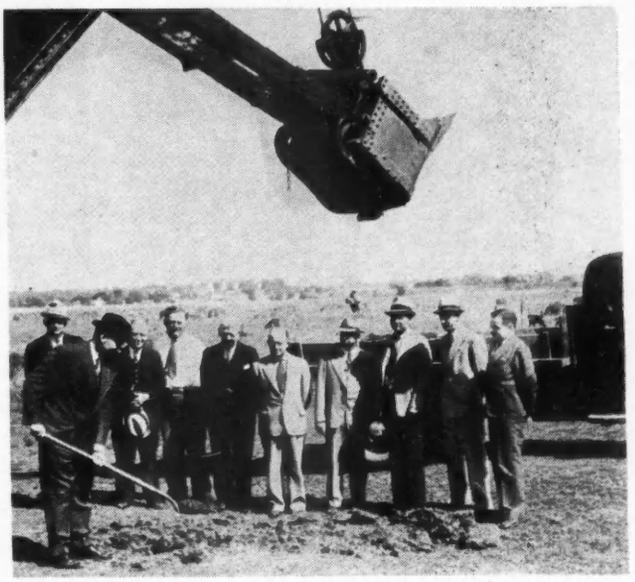
Electro Metallurgical Co., unit of Union Carbide and Carbon Corp., has contracted to purchase from the Tennessee Valley Authority a large block of industrial power which it proposes to use at a new plant to be located in the Wilson Dam, Alabama, area. The contract will run for a period of 20 years, unless a 90-day option to cancel is exercised by the company. The contract requires that the Authority be prepared to furnish as much as 40,000 kw. of power by 1941 should the company conclude to utilize such amount. The company will furnish its own transmission line to the boundary of the TVA property in the Wilson Dam area, where delivery of the power will be made. The proposed plant will be constructed principally for the manufacture of ferro-alloys, calcium carbide, and other electric-furnace products.

Chevrolet officials are beginning to interview applicants for jobs at the new Buffalo motor and axle plant. A force of about 3000 will be hired to man the plant which will be ready for production shortly after the first of the year. Alfred G. Gulliver, plant manager, said that out of the number to be employed, not more than 200 or 250 will be brought to Buffalo.

W. C. Lipe, Inc., is opening a new plant at Syracuse, N. Y., to be devoted to the manufacture of heavy duty clutches and vibration dampeners. Operations will be transferred from the older main plant in the same city.

The Diamond T Motor Car Co. has purchased the factory property in Chicago which it has for the last twenty years occupied on a rental basis, according to an announcement by President Tilt. The property is valued at $529,000, and the title was acquired in exchange for 21,259 shares of stock in the company, plus the cancellation of a $79,014 debt due the company. An additional twelve acres adjoining the property has also been purchased to provide for plant expansion.

NEW PLANT



is begun for the Mechanics Universal Joint Division of the Borg-Warner Corp. as G. C. Gridley, vice-president and works manager, turns the first shovelful of dirt. It will be a $500,000 factory with 234,000 sq. ft. of floor space. A continuous production line will be set up. Behind Mr. Gridley, second from the left, is E. D. Peacock, general superintendent; fourth, E. C. Traner, president; fifth, W. E. Gustafson, assistant secretary and treasurer; sixth, C. E. Swenson, consulting engineer; eighth, W. J. Simpson, general sales manager, and ninth, F. H. Lockwood, publicity head.

Cord Corp. to End Car Production

Manufacture of Auburn, Cord and Duesenberg automobiles will be discontinued by the Cord Corp., informed Wall Street sources insist. There has been no official indication of the corporation's plans for the use of Auburn and Duesenberg plants where the three cars were made, but the chances are said to favor use of the body plant at Connersville, Ind., for the production of parts for the automobile industry and other users of stampings. It is reported possible, however, that some of the manufacturing facilities may be sold. Managements of the several companies controlled by the Cord Corp. are studying the matter and, pending the completion of the reports, announcement of the program was withheld after a board meeting in New York Oct. 2.

MEN OF THE INDUSTRY

C. E. ATTWOOD has been elected president, and made a member of the board of directors of the Attwood Brass Works, Inc. **C. H. ATTWOOD** was made vice-president and a director, and **B. H. COOK** was made secretary and treasurer and a member of the board.

LOUIS R. CONRATH has been appointed sales engineer for the B-L Electric Mfg. Co., St. Louis, Mo.

JOSEPH H. McDUFFEE, president of the Prest-O-Lite Storage Battery Corp., has been elected vice-president of the Electric Auto-Lite Co. of Toledo. He will retain his Prest-O-Lite post but will make his headquarters in Toledo.

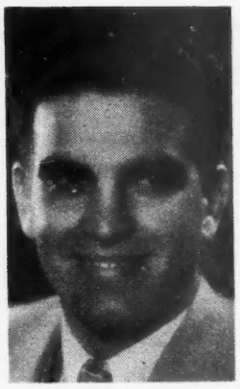
Plant Police May Join Union

The National Labor Relations Board has given a decision that may be far reaching in its effect, in the ruling in the Bendix labor relations that plant police, watchmen and apprentices are entitled to join a labor union. At the same time the NLRB certified the Bendix local union No. 9, United Automobile Workers of America, as the sole bargaining agency for the 4200 employes of the corporation. Supervisory employes such as foremen, superintendents, and executives are the only workers excluded from union membership according to the decision. Bendix officials contended that a watchman could not be loyal to both his union and police obligations.

SAE NOMINEES

BEECROFT
... treasurer

DAVIDSON
... councilor

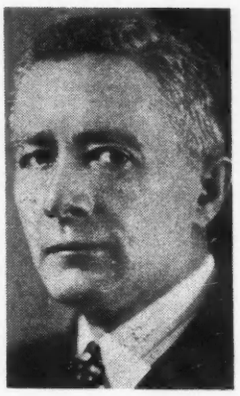


GRUNDER
... councilor

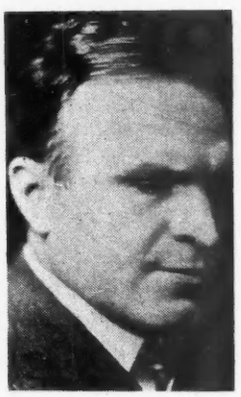
LEMON
... councilor

COLWELL
... councilor

KEYS
... councilor



STEWART
... councilor

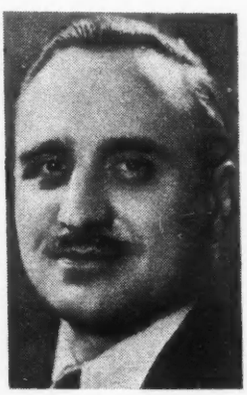


TEETOR
... councilor

WOOLSON
... councilor

CALDWELL
... vice-president, aircraft

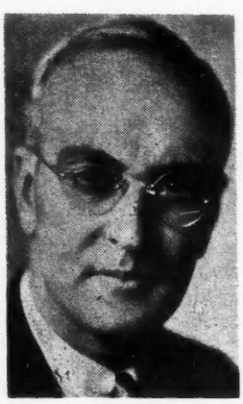
DUBOIS
... vice-president, aircraft engine



BEHN
... vice-president, Diesel engine

SIBLEY
... vice-president, fuels and lubricants

PATON
... vice-president, passenger car



SPRING
... vice-president, passenger car body

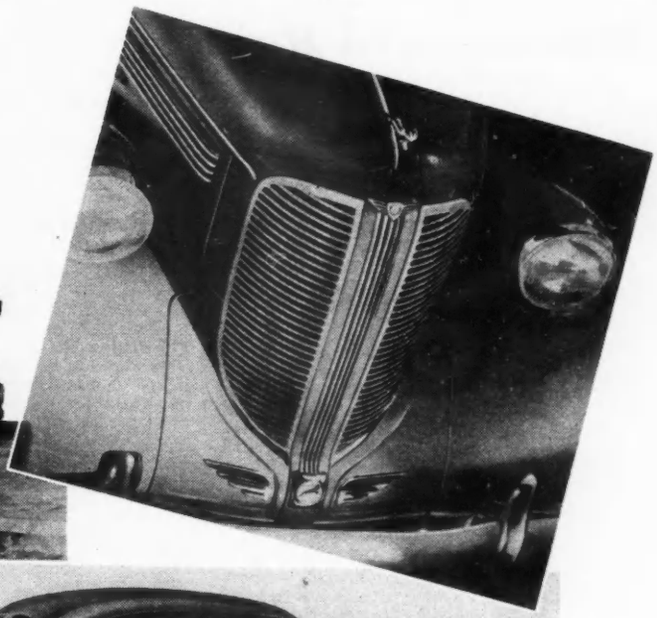
SAWYER
... vice-president, production

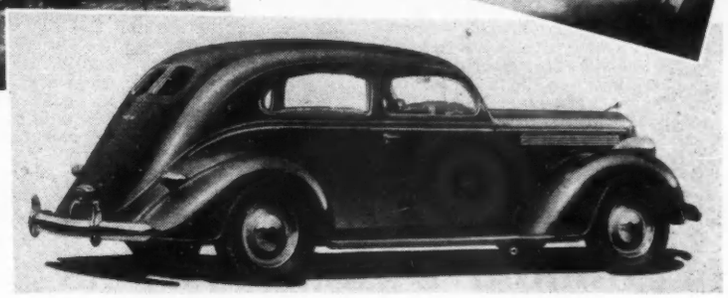
FRUDDEN
... vice-president, tractor and industrial power equipment

FAULKNER
... vice-president, transportation and maintenance

SIMI
... vice-president, truck, bus and railcar

NEWLY STYLED DODGE line is announced. The changes begin at the front end where a new die cast, two section radiator grille is used, and where headlights are mounted just inside the crown of the front fenders. A number of improvements have been made in body and chassis to increase the comfort and safety of driver and passengers. Among them are the use of sound-deadening materials, larger brakes and new upholstery.





Announce Dodge Line

Dodge division of Chrysler Corp. is announcing a line of ten body styles, including two 7-passenger models, sedan and limousine, on a 132-in. wheelbase. Standard wheelbase is 115 in. A number of changes have been made in the bodies and in the mechanical arrangements. These latter modifications include larger brakes, a new steering gear, and a number of improvements intended to increase ease of operation.

A new, two-piece die-cast radiator grille is used, the two parts separated by a vertical center design, while the frontal appearance is further improved by the use of fender-mounted headlights and a sheet-metal apron between the front fenders. Hood louvres are new in design, running backward toward a sharply raked windshield. Special efforts hove been directed at silencing the car in operation. These include the use of new sound-proofing materials and the mounting of the bodies on chassis outriggers with rubber spools. Upholstery and seat-cushion contours are new, and the front-seat adjusting lever is now placed at the driver's left. The instrument panel has been redesigned so that the driver need not turn his eyes from the direction in which the car is traveling, while all controls and accessories are sunk into the panel to eliminate projections.

Engines have a new-type spool-shaped "floating-power" mounting. Changes have been made in the clutch design to improve self-lubricating characteristics and to reduce wear. Brakes are now of 11-in. diameter and are balanced more closely than before. Refinements in the self-starter mechanism result in a considerable reduction in the pressure needed to operate it. Driver comfort has been increased also by dashboard mounting of a "pistol-grip" type parking brake.

Ask Ford Election

(Continued from page 469)

attempted to organize workers in Ford branches.

McDowell claimed the right of his organization to ask for an election under the Wagner Act. He said that the procedure was first to file application with the regional board which forwards the application to the national board in Washington which, in turn, sets date for hearing and appoints an examiner. After the hearings, the board decides on whether to hold an election. No reply has been received from the labor board, but McDowell said he expects to hear in about a week.

Chrysler, GM Windsor Plans

Chrysler Corp. of Canada, Ltd., will spend about $4,000,000 on new plant construction already under way at Windsor, Ont., John C. McGuire, sales manager, announced. Major unit in the plan is a new engine plant to supply both Canadian and export markets. Production in the plant may begin early in 1938. Improvements are also being made in other Chrysler plants at Windsor.

General Motors of Canada, Ltd., Oshawa, Ont., is planning to erect a large overhead steel conveyor connecting the two plants at a cost of approximately $100,000.

Pontiac Prices Raised

Pontiac division of General Motors Corp. has announced prices for 1938 models showing increases of $21.50 on most of the sixes and of $23.00 on most of the eights over August prices. Convertible model price increases are larger.

H. J. Klingler, general manager, announced that a new pricing policy brings within the factory delivered price several items which were not included in previous prices. They are a standard accessory group, safety plate glass, "duco" fenders and factory "get-ready" charges. The items total $63.50 on the 1938 six and $62 on the eight, making a simple comparison of prices for the two years inaccurate.

Prices, including everything except local taxes, standard dealer delivery charge and transportation costs from Pontiac, Mich., compared with 1937 prices plus $63.50 on the six and $62.00 on the eight, are as follows:

Pontiac

Six	1938	1937
Coupe	$795.00	$758.50
Sport coupe	850.00	828.50
Cabriolet	950.00	918.50
2-door sedan	825.00	803.50
2-door tr. sedan	850.00	828.50
4-door sedan	875.00	853.50
4-door tr. sedan	900.00	878.50
Convertible sedan	1260.00	1163.50
Eight	**1938**	**1937**
Coupe	$855.00	$832.00
Sport coupe	910.00	887.00
Cabriolet	1010.00	957.00
2-door-sedan	890.00	867.00
2-door tr. sedan	915.00	892.00
4-door sedan	935.00	912.00
4-door tr. sedan	960.00	937.00
Convertible sedan	1300.00	1202.00

Business in Brief

Written by the Guaranty Trust Co., New York

Business Rate Holds

The recent high rate of business activity was maintained last week. The weekly business index compiled by the "Journal of Commerce" stood at 103.9, as compared with 103.2 for the preceding week and 98.3 for a year ago. The current rise is the result of a seasonal increase in car loadings and a further expansion in coal production. Retail sales for the country as a whole were from 3 to 8 per cent above those in the preceding week, although fall buying had not reached its full momentum.

Railway freight loadings during the week ended September 25 totaled 840,446 cars, which marks a rise of 13,881 cars above those in the preceding week, a gain of 33,203 cars above those a year ago, and an increase of 210,511 cars above those two years ago.

Rails' Net Off

Net operating income of 137 Class 1 railroads during August amounted to $50,307,881, which is 22.2 per cent below the figure for the corresponding period last year. The decline in income was the result of increased costs of materials and labor.

Production of electricity by the electric light and power industry in the United States during the week ended September 25 was 4.4 per cent above that in the corresponding period last year.

According to the Board of Governors of the Federal Reserve System, industrial activity during August advanced from the levels in the two months preceding and on a seasonally adjusted basis was close to the volume of last spring. The board's index stood at 117, based on the 1923-25 average as 100, as against 114 for both June and July and 118 during the spring.

Production of lumber during the week ended September 18 stood at 78 per cent of the 1929 weekly average. Output was 26 per cent greater than new business and 20 per cent larger than shipments. All of the items showed gains above the preceding Labor Day holiday week.

Price Index Dips

Professor Fisher's index of wholesale commodity prices for the week ended October 2 stood at 90.7, as compared with 92.2 the week before and 92.4 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended September 29 showed no changes in holdings of discounted bills, bills bought in the open market, and Government securities. Money in circulation declined $9,000,000, and the monetary gold stock increased $40,000,000.

Automotive Metal Markets

Steel Demand by Car Producers and Others Still Small; Non-Ferrous Metal Prices Continue Erratic

Tonnage business from automobile manufacturers is still largely "just around the corner," as steel company sales executives put it, but moderate-size releases make up an encouraging aggregate. Much hullabaloo continues to surround analyses of the backwardness of automotive buying; delays in obtaining satisfactory dies for 1938 models, longer-than-usual runs on old models, fear of labor troubles, and more far-fetched explanations are being trotted out. One and all, however, serve to present an entirely false picture of nearly idle steel mills as the result of the tardiness of automotive steel consumers.

The major ailment of the steel industry at this stage is the utter lack of demand from consuming industries other than that of automobile manufacturing. This is especially true of the demand for what in the last few years have come to be classified as miscellaneous uses—this classification embraces anything from radio receivers to filing cabinets.

Steel buying by the construction industries, by the railroads and by railroad equipment manufacturers, in short by the leading steel-consuming industries, aside from automobile manufacturing, is admittedly disappointing. Were it not for these untoward conditions, the perfectly normal lull in steel buying by automobile manufacturers during the annual "changeover" period, would hardly have come in for the attention which it has received.

That competition among the steel sellers, keen as it has been right along, has become still more keen under prevailing conditions, goes without saying. So far, however, base prices come in for virtually no mention as possible weapons of competition.

In view of the broadening use of zinc in automotive die-castings, the recession in the price of that metal is of much interest to buyers. Following a drop of $15 per ton last week, several transactions in 1938 futures were recorded on the New York Commodity Exchange at $10 per ton under the prevailing price for spot delivery.

When one of the custom smelters cut the price of copper to 12 cents, he was thought to have gone too far by others who withdrew from the market for the time being and, as a result, the market moved fractionally higher, first to 12¼ and then to 12⅓ cents, with 12¾ cents chalked up at the beginning of this week. Mine producers continue to quote 13 cents, all business at prices lower than this level going to custom smelters. The reimposition of restriction quotas has revived the sunken spirits of London speculators. In producers' selling organizations the belief holds forth that, after the custom smelters have sold their intake quotas, stabilization of the market at around 13 cents will be accomplished.

Tin buyers complain of the wide price swings of the market these days and blame the International Control scheme, which was set up for the very purpose of obviating these costly ups and downs, but in actual practice appears to multiply them. On Monday buyers had to pay 57⅜ cents per ton for spot Straits, $27.50 more per ton than they could have bought it on the preceding Wednesday. Then on Tuesday of this week the market declined $30 a ton and spot Straits was offered at 55⅞ cents. It is pointed out that much dredging capacity in the Malay producing section is artificially being kept idle, presumably to steady prices which, in fact, act more erratic than in years. Press reports of Japan as a heavy tin buyer in London must not be interpreted as denoting anything out of the ordinary. The large Japanese trading houses have been for years among the leading operators in the New York as well as the London markets, and tin buying is a daily routine with them.

—W. C. H.

Company Earnings

Waukesha Motor

Waukesha Motor Co. reported net income for the fiscal year ended July 31 of $1,026,824 or $2.56 per share. This was calculated after Federal surtax. For the preceding year net income was $731,553 or $1.83 per share.

Eaton Manufacturing

Eaton Mfg. Co. reported net income for the seven months ended July 31 of $1,865,306.

Graham Cars Previewed

First glimpse of the 1938 Graham, and first information concerning the coming year's sales and advertising program, were given distributors and dealers from points east of the Rockies at the Graham-Paige factory last week. R. C. Graham, executive vice-president of the corporation, told of the timing of production on the new cars. "Our announcement date will be October 27," said Mr. Graham. "We could have announced earlier by making only a few changes in the 1937 car, but we believe this is the opportune time to completely redesign the line, and it takes time to build all the dies and tools necessary for a complete change." W. H. Neely, chief design engineer, responsible for the development of the new model, described its salient sales points. Storrs J. Case, director of advertising and sales promotion, outlined the program of sales helps which are planned, and M. V. Wieland, from the J. Walter Thompson Company advertising agency, told of the magazine, newspaper, tradepaper and outdoor advertising campaign which will launch the new car. F. R. Valpey, vice-president and general sales manager, conducted the meeting.

. . . *slants*

EXPORT DELAYS—*The Department of Commerce reports that importers in Buenos Aires, Argentina, are voicing increasing criticism of the delays experienced in securing delivery of materials and commodities ordered from abroad. The commercial attache there feels that 90 days should be enough, now that airmail permits receipt of orders very promptly. It is admitted that labor troubles and materials shortages make some delays unavoidable.*

FARM BELT VIEW—*Commenting on the rise in automobile prices, "The Agricultural Situation" says the advances are the result of reduced output per worker at the plants. Cost to the farmer of a new automobile is described in this way: "Single steers have sold recently for as much as $300 a head. So, just three of these neutralized sons of bovine matrons would bring enough*

to buy what passes for a mighty good automobile. That's tops, of course, but if the steers are not worth quite so much, it is only necessary for the farmer to throw in a couple of shoats or a calf and he has the wherewithal to set himself up with fine transportation."

PARKING A PROBLEM—*A truck so large that it cannot be legally licensed is starting on a tour of this country, Canada and Mexico under a special Government permit. It is 52 ft. long. The truck, a tractor-trailer unit, carries a large number of historical objects such as the first steam engine model from the Department of Patents, first model of the cotton gin and the like.*

Car Safety Suggestions

Paying tribute to automobile manufacturers, designers, and maintenance men, the U. S. Bureau of Public Roads, in its special report on highway safety and traffic conditions, has advised Congress that from the standpoint of safety, automotive engineers recognize their obligations and are doing all they can to combine proper balance in a single mechanical unit with "many different and often conflicting requirements for safety, efficiency and comfort."

The bureau reported that only 64,000 or 7 per cent of the vehicles involved in accidents in 1936 were in a "dangerously defective condition."

The report characterized safe design as "partly a problem of cost and partly one of balancing alternatives which may be mutually conflicting." On the subject of visibility, it was suggested that a number of changes be made for greater safety, including narrower windshield pillars, better seat position, adjustable glass angles and glare shields to eliminate reflections.

Other recommendations on passenger car interiors included the elimination of "interior projections" where possible and that indispensable ones be designed and located so as to reduce to a minimum "the possibility of personal injury."

Listed as "pedestrian hazards" which the report said should receive the consideration of designers, were exterior door handles, radiator emblems, and the sharp edges of front and rear bumpers.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Investor's Opportunity

Many American capitalists are reported loath to interest themselves in the motor industry because of the lack of basic patents on the self-propelled vehicle, assuming that without such protection the investment would not be a safe one. This is a gross error.

It may be true that no basic patents are obtainable in this line, but a number of valuable detail patents on motors and transmission mechanisms have already been taken out, and others will be brought to light by the experience of manufacture. The first market of the inventors who have improvements in motor vehicles to offer, will be the reputable manufacturers of such vehicles. Hence, it is evident that the manufacturer who starts with a practical vehicle embodying a few good detail patents, sufficient capital to handle his business, and a fair amount of commercial experience, has all the chances in his favor. . .

From *The Horseless Age*, Oct., 1897.

New Truck Registrations*

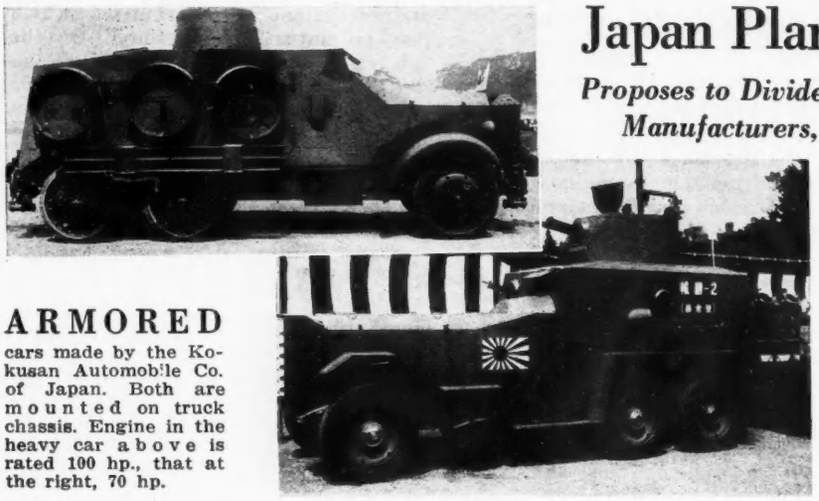
	August 1937	July 1937	August 1936	Eight Months 1937	Eight Months 1936	Per Cent Change, 8 Mos., 1937 over 1936	Per Cent of Total Eight Months 1937	Per Cent of Total Eight Months 1936
Ford	15,859	18,262	15,954	149,073	130,360	+ 14.3	32.39	29.66
Chevrolet	18,806	17,011	20,356	135,938	154,549	− 12.1	29.53	35.17
International	7,446	7,381	6,115	53,212	47,709	+ 11.4	11.56	10.86
Dodge	6,665	6,333	8,071	44,629	59,541	− 25.1	9.69	13.55
G. M. C.	4,394	4,088	2,977	32,051	17,675	+ 81.3	6.96	4.02
Plymouth	1,570	1,653	246	9,698	2,060	+370.0	2.11	0.47
Diamond T	627	719	759	6,128	5,382	+ 14.0	1.33	1.22
White	411	530	493	4,220	3,637	+ 16.1	0.92	0.83
Studebaker	541	587	314	4,093	2,167	+ 88.5	0.89	0.49
Mack	421	607	426	3,983	2,446	+ 62.9	0.87	0.56
Terraplane	521	562	197	3,866	1,443	+167.9	0.84	0.33
Reo	317	445	313	3,200	2,602	+ 23.2	0.69	0.59
Federal	158	219	242	1,816	1,941	− 5.6	0.39	0.44
Autocar	171	281	139	1,498	822	+ 82.2	0.33	0.19
Brockway	134	152	163	1,149	1,163	− 1.4	0.25	0.26
Indiana	97	91	128	1,031	1,109	− 6.9	0.22	0.25
Stewart	87	104	124	888	816	+ 6.2	0.19	0.19
Divco	115	80	65	844	689	+ 22.5	0.18	0.16
Willys-Overland	105	90	217	719	1,629	− 55.8	0.16	0.37
Stutz Pak-Age Car	57	90	.....	484	.....	.....	0.11	.....
F. W. D.	30	24	16	312	231	+ 53.8	0.06	0.05
Sterling	14	34	39	234	155	+ 50.8	0.05	0.04
Kenworth	5	15	.....	92	.....	.....	0.02	.....
Schacht	1	2	.....	37	.....	.....	0.01	.....
Miscellaneous	129	111	174	1,037	1,316	− 21.2	0.23	0.30
Total	58,681	59,451	57,528	460,212	439,442	+ 4.8	100.00	100.00

* Complete except for Wisconsin.

New Passenger Car Registrations*

	AUGUST 1937	JULY 1937	AUGUST 1936	EIGHT MONTHS 1937	EIGHT MONTHS 1936	Per Cent Change, 8 Months, 1937 over 1936	Per Cent of Total Eight Months 1937	Per Cent of Total Eight Months 1936	TEN MONTHS 1937 Models	TEN MONTHS 1936 Models	TEN MONTHS Per Cent Change
Ford	53,327	83,188	58,212	628,919	553,687	+ 13.7	23.69	22.53	719,980	664,664	+ 8.3
Chevrolet	69,711	73,910	72,526	555,511	697,652	− 20.4	20.93	28.39	699,164	818,673	− 14.5
Plymouth	42,848	48,586	37,860	354,982	348,377	+ 2.0	13.37	14.18	444,385	411,229	+ 8.0
Dodge	23,618	26,522	19,415	194,707	175,278	+ 11.2	7.34	7.13	236,945	208,154	+ 14.0
Pontiac	20,538	22,846	12,537	159,862	122,525	+ 30.6	6.02	4.99	191,962	144,945	+ 32.0
Oldsmobile	17,172	20,244	12,684	144,760	140,449	+ 3.2	5.45	5.71	169,078	168,017	+ 0.6
Buick	18,050	20,582	11,173	142,990	108,291	+ 32.3	5.39	4.41	180,675	133,194	+ 35.8
Packard	7,534	8,933	5,762	74,009	39,420	+ 88.0	2.79	1.60	88,506	48,073	+ 84.1
Chrysler	8,277	8,717	4,175	64,996	40,414	+ 61.0	2.45	1.64	77,317	45,094	+ 71.8
Terraplane	6,975	7,919	5,728	59,109	56,811	+ 4.0	2.23	2.31	72,687	66,810	+ 9.0
DeSoto	7,321	7,582	3,665	54,534	30,604	+ 78.0	2.05	1.25	63,699	34,363	+ 85.5
Nash	5,989	6,722	2,885	54,409	29,893	+ 82.0	2.05	1.22	62,811	35,167	+ 79.0
Studebaker	5,293	6,590	2,556	52,805	43,347	+ 22.0	1.99	1.76	65,108	49,313	+ 32.0
Willys	5,147	5,993	1,126	39,963	8,763	+355.0	1.51	.36	41,645	10,974	+280.0
LaSalle	2,705	3,026	843	21,402	8,111	+164.0	.81	.33	25,874	10,303	+151.0
Lincoln	2,173	2,278	1,031	19,600	8,854	+110.0	.70	.36	22,364	9,826	+122.7
Hudson	1,207	1,320	1,309	11,501	15,416	− 25.3	.43	.63	14,887	19,584	− 24.0
Graham	1,286	1,406	1,282	10,366	11,647	− 11.0	.39	.47	12,904	13,479	− 4.2
Cadillac	987	952	900	8,676	7,979	+ 8.4	.33	.32	11,030	10,164	+ 8.2
Cord	130	137	140	964	855	+ 12.8	.04	.03	1,102	855	+ 28.8
Pierce-Arrow	1	4	80	147	554	− 73.4	.01	.02	247	710	− 65.2
Auburn	5	3	98	144	1,535	− 90.7	.....	.06	279	2,043	− 86.5
Hupmobile	23	.....	.....	23	.....	.....	.....	.....	.....	.....	.....
Miscellaneous	97	69	489	922	7,162	− 87.0	.03	.30	2,550	9,112	− 72.1
Total	300,414	357,531	256,476	2,654,301	2,457,624	+ 8.0	100.00	100.00	3,205,179	2,915,146	+ 10.0
Chrysler Corp.	82,064	91,407	65,115	689,219	594,673	+ 12.3	25.20	24.20	822,346	698,840	+ 17.8
Ford and Lincoln	55,500	85,466	59,243	647,519	562,541	+ 15.0	24.40	22.89	742,344	674,690	+ 10.2
General Motors	129,163	141,560	110,663	1,033,201	1,085,007	− 4.8	38.93	44.15	1,277,783	1,285,496	− 0.7
All Others	33,687	39,098	21,455	304,362	215,403	+ 41.4	11.47	8.76	362,706	256,120	+ 41.3

* Complete except Wisconsin.



ARMORED cars made by the Kokusan Automobile Co. of Japan. Both are mounted on truck chassis. Engine in the heavy car above is rated 100 hp., that at the right, 70 hp.

Japan Plans 5-Year Car Control

Proposes to Divide Bulk of Field Between Two Licensed Manufacturers, Extend 1936 Plan to Parts Makers

To prevent unnecessary duplication of identical manufacturing facilities by competing manufacturers and to check unwholesome developments in Japan's growing automotive industry, the Department of Commerce and Industry is making preparations for a five-year plan for the consolidation of the automobile industry.

Details of the draft plan, as reported by the *Nikkan Kogyo Shimbun*, are as follows:

1. Efforts will be made to expand the productive capacity of the two licensed manufacturers, the Toyota Automobile Co. and the Nissan Jidosha; to assist them in training skilled labor; and to induce them to enter into a mutual agreement in respect to a division of the field. The virtual duplication of Nissan's small-size "Datsun" chassis by almost a dozen competing non-licensed manufacturers may be checked in some way.

2. In view of the importance of subcontracting in Japan's automobile industry, the "control" scheme of 1936 may be extended so that it also covers the parts manufacturing business so far as it is connected with the licensed automobile manufacturers. Control may also be exercised over common parts makers who offer their products on the open market. Standardization is projected generally.

3. Official steps are to be taken to promote the supply of raw materials from within the Japan-Manchukuo areas. Manchukuo will be relied upon to an increasing extent for a supply of aluminum, iron and special steels.

4. In view of the critical situation on the continent, demand for ordnance vehicles in Manchukuo and Korea is increasing at a fast rate. The only Japanese-controlled automobile manufacturing company, the Dowa Jidosha of Hsinking, is incapable of mass production. As a result, demand in these districts must be supplied from Japan proper. It is now contemplated to effect a division of manufacturing between the Dowa and Japanese makers, with the latter supplying the continental demand for commercial vehicles, while the Dowa Jidosha confines its manufacturing program to special vehicles including military trucks, tanks, and armored cars such as may be developed in cooperation with the Kwantung military authorities.

See New Fair Trade Act

Draper Says Anti-Trust Laws Should be Overhauled

President Roosevelt's Constitution Day speech, in which he referred to the necessity of curbing disruptive trade practices, is being interpreted in New Deal circles as indicating that Mr. Roosevelt is ready to push for trade practice legislation to supplement the minimum wage and maximum hour bill pending in Congress.

Ernest Draper, Assistant Secretary of Commerce, an administration lieutenant who hopes the President will back such legislation, insists, however, that a trade practice law, while still definitely under consideration, is lying dormant for the time being. Draper, who has conferred frequently with Donald Richberg, former NRA administrator, on possible trade practice moves, told AUTOMOTIVE INDUSTRIES that one of the most baffling problems faced by the administration before it moves definitely to sponsor a new trade practice law is clarification and revision of the anti-trust laws.

Minor revision could be written into a trade practice law, it is pointed out, just as it is in one bill pending in Congress at the present time, but key administration advisers have been represented as favoring a general overhauling of the anti-trust laws as against doing the job "piece-meal."

Draper's view is that business is entitled to have its rules of conduct defined in a "clear and understandable manner," and that without some changes, members of industry are "hopelessly at sea over what they are and are not permitted to do."

"Court decisions are usually depended upon to clarify controversial points," Draper says. "But our anti-trust laws in particular have become more and more muddled as a result of judicial interpretation so that now you can quote a judicial decision for almost any act of business conduct in the anti-trust field."

Pointing out there is considerable sentiment among some business groups for trade practice legislation, Draper, who was recruited from business ranks when the New Deal first came into power, declares that such a law cannot be avoided if "the small business units are to be given protection."—L. W. M.

Seasonal Lay Offs in August

Seasonal lay offs in the automobile plants accounted for the major changes in the Department of Labor employment figures for August.

The quit rate in the automobile and body field rose to 1.01 per 100 employees against 0.91 in July and 0.99 in August, 1936. The discharge rate dropped to 0.14 from 0.21 in July, against 0.22 a year before. The lay off rate was 21.01 against 5.33 in July and against 26.94 in August, 1936, making the total separation rate 22.16 against 6.45 in July and 28.15 in August last year. Accession rate was 3.46 against 1.98 in July and 4.30 in August, 1936.

In the automobile parts field the quit rate was 1.20 against 1.37 in July and 1.43 a year earlier. The discharge rate was 0.27 against 0.29 in July and 0.36 a year earlier. Lay off rate was 6.80 against 7.27 in July and 3.85 in August last year, making the total separation rate 8.27 against 8.93 and 5.64 in the prior periods. Accession rate was 5.61 against 3.35 and 5.47 previously.

William L. Rickard

William Luiz Rickard, head of the advertising agency, Rickard & Co., died at White Plains, N. Y., Oct. 5. Mr. Rickard began his business career thirty-five years ago with the Otis Elevator Co. which he left after several years to become vice-president of the Ray D. Lillibridge, Inc., advertising agency. In 1912, with Clifford Sloan, brother of Alfred P. Sloan, Jr., chairman of the board of General Motors Corp., he formed the agency of Rickard & Sloan which became Rickard & Co., Inc., two years ago when Mr. Sloan retired.

Eaton Gets Foundry

Eaton Mfg. Co., in a listing application made to the New York Stock Exchange, disclosed that it is purchasing the property, assets, business and goodwill of the Eaton-Erb Foundry Co., a Michigan corporation. Consideration is 21,750 shares of Eaton Mfg. Co. common stock. Eaton Mfg. Co. already owns the 1000 outstanding shares of Eaton-Erb preferred and 750 of its 1250 common shares.

Production Soaring

(Continued from page 469)

September quarter of 1936, an increase of 18.7 per cent. The nine months' total this year becomes 3,946,000 against 3,461,468 in the corresponding period last year. The industry is therefore already working on its fifth million vehicles for the current year.

Reflecting the accelerated activity in the industry this month, the factory employment index of the Detroit Board of Commerce shot up to 110.4 as of Sept. 30 from 86.6 on Sept. 15, and compares with 83.9 on Sept. 30 last year, showing that the new car manufacturing program is considerably further along than it was a year ago. In 1936, the employment index dropped to a low for the year of 75.7 on Sept. 15. This year the low point was 83.6 on Aug. 31.

—H. E. G.

Chevrolet has launched production of 1938 model cars in its Chevrolet and Fisher Body plants at Buffalo, it was announced by Maurice Howe, general manager. Approximately 1600 employes have been called back to work in the two plants and the regular schedule of 400 cars a day is expected to be attained by the end of the month. In the meantime the Ford plant there is getting ready to resume production within a week or so when it will call some 1500 employes back on the job. Automotive parts makers in the area such as Houde Engineering, Trico Products, Standard Mirror, Fedders Manufacturing and others are nearing capacity levels on 1938 model output.

Fiat to be Shown at N. Y.

A large exhibit for the New York Automobile Show marks Fiat's entry into the American market, according to Larry Green, director of sales for The Advance Corporation, Butler, Pa., American importer and distributor for Fiat.

Included will be several styles of the Fiat "500" which is said to give high gasoline mileage and which will deliver in the United States for less than $600, fully equipped. One of the models is a cabriolet with a sliding top. Also included are the Balilla and the "1500" in both standard and custom models. All models, including the "500," have all-steel bodies, hydraulic shock absorbers, hydraulic brakes and independent front wheel suspension.

Cutting Fluids Research

Following a period of over 18 months of initial activity, the independent Research Committee on Cutting Fluids, whose chairman is Joseph Geschelin, Detroit technical editor of AUTOMOTIVE INDUSTRIES, met last week for the purpose of approving two major research projects for publication in the 1938 edition of the Metals Handbook of the American Society for Metals. The first of the reports concerns the analysis and interpretation of a questionnaire on cutting fluids practice. It covers a very comprehensive field of metal cutting establishments and gives an excellent picture of current practice. The second report deals with the machinability of commonly used SAE steels, its feature being a table giving the rating of different steels in the order of ease of machining.

Woolson on Trip

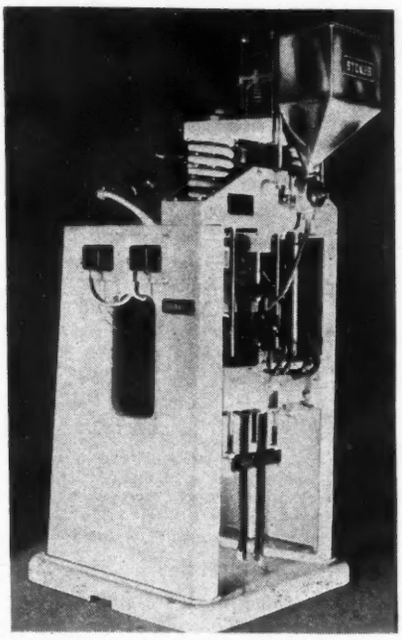
H. T. Woolson, executive engineer, Chrysler Corp. and president of the SAE, has left for the Pacific Coast to visit sections of the society. His itinerary called for him to arrive at Los Angeles, Oct. 7 after stops at Chicago and Denver. He arrives in San Francisco, Oct. 11; Portland, Ore., Oct. 13; Seattle, Oct. 15, and then returns to Detroit by way of Chicago.

TOOLS OF TOMORROW

Automatic Molding Machine

. . . handles thermo-setting plastic materials of the phenolic base and urea compound types.

Descriptive details of its completely automatic machine for molding thermosetting plastic materials of the phenolic base and urea compound types have been released by the F. J. Stokes Machine Co., Philadelphia.



Stokes automatic machine for molding thermosetting plastic materials.

As in conventional molding methods, output depends largely on curing time. According to the manufacturer, a small article with light wall sections can be molded in about two minutes; larger, heavier pieces may take six to seven minutes. Small pieces from 1 in. to 1¾ in. in depth may be molded, depending on shape. The largest piece so far molded with this equipment is 3 1/16 in. diameter by 3/16 in. thick. Changing molds and setting controls for producing different parts requires from 30 to 60 min. The machine is intended primarily for the use of single cavity molds of the positive type.

The feeding device will handle any free flowing granular material, and is adjustable to feed from 0.9 to 5.26 cu. in. of material.

The machine is safeguarded against damage to either mold or mechanism by an up-stroke limit switch, a down-stroke limit switch, and an operation check. The latter is a trap device through which each ejected molded part must pass, the trap being the control of an interlocking circuit that keeps the machine in continuous operation or stops it should there be an interruption in the flow of parts. Additional protection is provided by a spring suspension method of supporting the mold that makes it practically impossible to apply pressure sufficient to damage either punch or mold.

Plunge Cut Grinder

. . . has 14-in. swing over table and 12-in. length between centers

A new plain cylindrical grinder designed to do plunge cut grinding only has been developed by the Fitchburg Grinding Machine Corp., Fitchburg, Mass. The machine has no table traverse and the wheel spindle is arranged to reciprocate. Truing devices can be supplied for semi-automatic operation and either hand truing or wheel hood mounted type may be used, depending on the work to be done. Built around one of the standard Fitchburg Bowgage wheel head units, this machine has a complete automatic cycle dial controlled from the panel.

Headstocks for either live or dead spindle operation can be furnished and the complete cycle can be interlocked to be operated from one lever. A retractable headstock center with a solid footstock which has advantages for some classes of work can also be supplied.

Essential specifications include: max-

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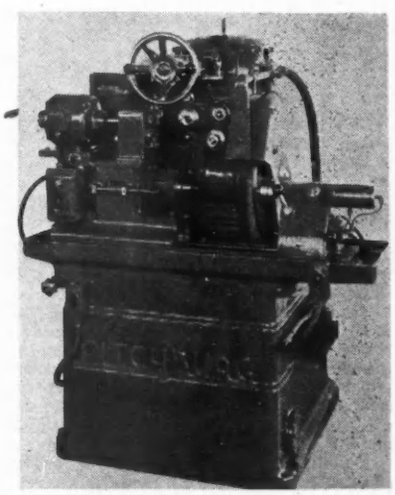


Fitchburg plain cylindrical grinder for plunge cut grinding.

AUTOMOTIVE ABSTRACTS

Heat Treatment Improves Copper-Aluminum Alloy

It is well known that the 4 and 8 per cent copper-aluminum alloys currently used for castings may have their properties improved by heat treatment. This improvement is due to a change in the grain structure which, however, is never complete, even though the treatment may be extended over several days, which is rather onerous in industrial operations.

It has been found by Dr. Pacz that a small addition of titanium under certain conditions very definitely improves the coarse texture (grain structure) of copper-aluminum alloys, and makes the heat treatment more effective, at the same time reducing its duration to a few hours, and permits of obtaining a casting metal of superior mechanical qualities. Dr. Pacz claims a tensile strength of 42,000 lb. per sq. in. with an elongation upward of 4 per cent on test pieces cast in sand and heat treated.

The alloy referred to was easily produced under the special conditions obtaining in the laboratory, by melting small quantities in the crucible, but its industrial production proved quite difficult. The problem to be solved consisted in producing in furnaces of large capacity, ingots which after remelting in the foundry by a simple and easy process, would regularly produce the claimed mechanical properties. This problem has been solved, and it is now possible to produce regularly, in furnaces of large capacity, an alloy which after a second melting, on test pieces cast in sand, shows tensile strengths of 45,000 to 52,000 lb. per sq. in. with elongations of 6 to 10 per cent. The specific gravity is 2.78. This alloy, known as A P 33, is claimed to constitute a decided advance over the ordinary copper-aluminum alloys and to have been substituted for cast steel in numerous cases, where lightness of construction is important. Its principal applications so far have been in railcars, automobiles, war material and telephone installations in the country.

The optimum copper content of the new alloy is 4.60 per cent and the optimum titanium content, 0.25 per cent, but it is important that the titanium be introduced into the bah in such a form that the whole of it can enter into solid solution at a temperature not exceeding 1375 degs. F.—*Revue de l'Aluminium* for July and August, 1937.

Determining Thickness of Nickel Coatings

When providing objects with a nickel coating by the electrolytic method, the average thickness of the coating can be regulated by means of the current density and the duration of current flow. However, in the case of objects with irregular surfaces the coating will not be uniform, being thicker on projecting surfaces and thinner at the bottom of depressions. Moreover, poor contacts may result in an irregular distribution of current, and the loss of thickness due to polishing also is variable. It may thus become necessary to determine the actual thickness of the coating at various points of the surface of the plated article.

A chemical method employed to determine the thickness is based on the fact that a nickel anode in a solution of sodium cyanide becomes passive only if the current density exceeds a certain value. The plated object is cleaned, dried and weighed, and then immersed in an agitated solution containing 1.5 lb. of potassium cyanide per gallon of water. A light current is sent through the bath, the nickeled article being made the anode, with a steel cathode. The current strength is then gradually increased until the nickeled anode becomes passive, which is indicated by a material increase in the voltage. Next the current flow is reversed for a period of 30 secs., its density being made sufficiently high to eliminate the passivity. Current is then sent through the bath in the original direction again at a density two-thirds that which originally caused the passivity. It is maintained at this value until the anode becomes passive once more. It is then reversed again and the operation is repeated until the nickel is completely dissolved. At that moment the current density should be 2 milli-amperes per square inch. The object is withdrawn from the bath, rinsed, dried and weighed. The difference between the original and the final weights gives the weight of the nickel coating. The time required to dissolve a coating of 0.0005 in. is 80 minutes, provided the temperature is maintained between 60 and 70 degs. F.—*The Nickel Bulletin* for June.

Aircraft Engines and Metallurgy

In a period of only six years previous to 1937 the output of aircraft engines, expressed in horse powers per cu. ft. of cylinder displacement, increased by from 50 to 100 per cent, according to Dr. D. R. Pye, Director of Scientific Research, Air Ministry, who presented a paper on Metallurgy and the Aero Engine before the Institute of Metals. There is little difference in outward appearance between the earlier and the modern engine, and the question arises as to how this

(Turn to page 486, please)

Cadillac-LaSalle Preview

Cadillac-LaSalle division of General Motors Corp. showed its new models to dealers in Detroit, Sept. 28 and 29. The new cars will be announced to the public during October.

More than $6,500,000 is being spent by Cadillac-LaSalle for equipment and tools in preparation for its 1938 series of cars, Nicholas Dreystadt, general manager, stated.

Improvements that will step up the efficiency of the factory range from new loading platforms to giant sheet metal presses. At several points in the factory new conveyor systems are being installed to eliminate the bottlenecks in the unloading of parts. The old plating department has been virtually scrapped, Mr. Dreystadt said, and the 1938 program calls for expansion in operations. The driveaway and truckaway department, which has become an increasingly important unit with the higher volume cars, will be relocated and enlarged. A ventilating system has been installed in the foundry. Rear axle and transmission advances for 1938 are responsible for a considerable revision in manufacturing. A large part of the outlay, Mr. Dreystadt continued, will go toward re-equipment of processes for the construction of Fleetwood bodies. A new Fleetwood design entails a complete rehabilitation of the line.

Apparently anticipating the formal announcement date, Cadillac dealers in Detroit are showing the 1938 LaSalle to the public. The die cast radiator grille is heavier and offers a somewhat larger frontal area. The hood now is of alligator type, hinged at the cowl with fixed sides. The lamps now are mounted on the fender catwalk. In the absence of complete mechanical data, the only obviously new mechanical feature is the elimination of the conventional wobble stick and the use of remote control of the transmission shifting from the steering column. It is understood that this is standard equipment on all Cadillac and LaSalle cars. In addition, the exhaust spreader, a minor feature last year, has been eliminated.

Allege Collusive Tire Bids

Department of Justice and Federal Trade Commission officials are scanning evidence submitted by the Treasury Department alleging that 14 prominent rubber companies bid "identical prices to the cent" on a wide variety of automobile tires and tubes. Although jurisdiction of the case is in doubt it is expected that the Justice Department's facilities give it a slight edge over the FTC on cases in this category and that it will proceed against the alleged collusive bidders.

At the same time, the Treasury's procurement division announced it had awarded the Government's $1,000,000 tire contract for the next six months to Sears, Roebuck & Co. and that "substantial" savings had been effected thereby. It is expected that Sears, Roebuck will buy its tires to fill the contract from one or more of the firms which have been charged with collusive bidding.

Firth-Sterling Steel Co. has issued a folder containing drawings and use data on sintered carbide tips and tools.*

A new Japanese magazine, the *Internal Combustion Engine*, has made its appearance. It is edited by Dr. Masao Kumo, Tokyo Imperial University, and seven-time president of the Society of Mechanical Engineers of Japan. The first issue contains a number of technical articles.

Carboloy Co., Inc., has just issued an illustrated booklet, T37, giving in detail a process by which users of the product can make Carboloy-tipped tools in their own plants.*

The October issue of the *Bakelite Review* contains an article on the introduction of transparent molded phenolics describing the materials in detail.*

Binks Mfg. Co. has published a 60-page catalog covering its entire line of spray equipment.*

Heil & Co., Cleveland, has issued a new folder dealing with methods of **heating corrosive liquids.** The folder gives data on the company's line of equipment manufactured to handle such materials.*

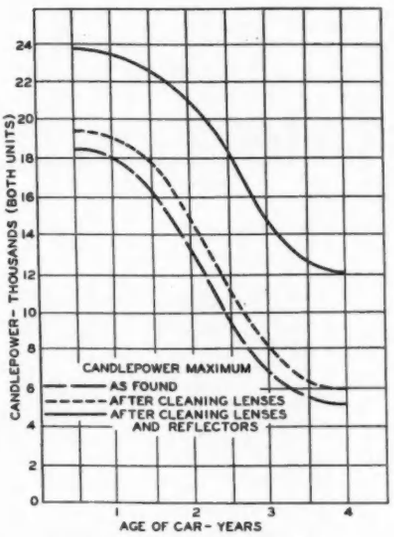
Complete data on **Ihrigizing,** a process for making ferrous metals resistant to corrosion, heat, and wear, is given in Bulletin No. 2 issued by the Globe Steel Tubes Co., Milwaukee, Wis.*

A new **specifications file folder** has been issued by Laminated Shim Co., Long Island City, N. Y.*

The October issue of **Oxy-acetylene Tips** contains an article on **flame hardening.** It is published by the Linde Air Products Co., unit of Union Carbide and Carbon Corp.*

The National Battery Manufacturers Association, New York City, has just issued its third **statistical year book** which is offered to the membership and other interested parties at twenty-five cents a copy. In addition to the association's sales indices, the work contains statistics on production of storage batteries and materials consumed.

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.



HEADLIGHT efficiency gains after lenses and reflectors are cleaned, as this chart of the results of a survey by the General Electric Co. shows. It also shows deterioration with age.

Holds Driveaway Under Law

Driveaways come under the Motor Carrier Act of 1935, it is the opinion of Examiner A. E. Later in a proposed report to the Interstate Commerce Commission recommending that John P. Fleming, Detroit, doing business as John P. Fleming Driveaway Service, is entitled to continue operation as a common carrier by motor vehicle over irregular routes between Detroit and points in 12 states, passing through 14 states. The 12 states are Alabama, Arkansas, California, Georgia, Kentucky, Michigan, North Carolina, Oregon, South Carolina, Tennessee, Texas and Washington. Exceptions to the report must be filed with the ICC by Sept. 30.

There was strong railroad and other opposition to the granting of the application. The chief question was whether the Fleming service, operated continuously since 1932, is within the jurisdiction conferred on the ICC by the Motor Act. The examiner said it is. It was claimed that driveaway service is nothing more than a chauffeur. The examiner said that the Fleming service is a common carrier. He said that the applicant holds himself out to move motor vehicles for anyone who may request it to destinations in any of the states for which application is made. The examiner also rejected the railroad contention that the applicant should be requested to confine operations to fixed routes and fixed termini. He accepted the contention of the Fleming service that its operation requires great flexibility, both as to routes and as to points to be served.

Want Layoffs, Not Part Time

The United Rubber Workers Union, CIO affiliate, will agree to layoffs in preference to continuance of the share-the-work program at the Goodyear Tire & Rubber Company's Akron tire plants, if the company cannot increase its production tickets to give all present employes at least 24 hours of work a week, and provided the layoffs apply only to the 1700 new employes hired by Goodyear since its six weeks strike early last year.

The union presented this proposition to the Goodyear management Sept. 20 following its approval at a mass meeting of Goodyear union members. Previous to the union decision Goodyear had scheduled an employe referendum on the issue, but this was cancelled when the National Labor Relations Board ruled that the URW's recent victory in a collective bargaining election gave the union the right to negotiate the matter for all employes with the Goodyear management.

While the Goodyear management remains non-committal on the union proposal, it is understood that layoffs of only the 1700 newer employes will not be sufficient to bring the work week up to 24 hours for present employes. Tire department workers have been averaging only 12 to 15 hours a week for several weeks.

Calendar of Coming Events

DOMESTIC SHOWS

New York, National Automobile Show, Oct. 27-Nov. 3
Toledo, O., Automobile Show. Oct. 27-Nov. 3
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Washington, D. C., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 6
Cincinnati Automobile Show. Oct. 31-Nov. 6
Altoona, Pa., Automobile Show....Nov. 2-6
Akron Automobile Show .....Nov. 6-12
Brooklyn Automobile Show.....Nov. 6-13
Chicago Automobile Show .....Nov. 6-13
Columbus Automobile Show .....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Detroit Automobile Show.....Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J. .....Nov. 6-12
Newark, N. J., Truck Show.....Nov. 6-12
Buffalo, N. Y., Automobile Show..Nov. 6-13
Indianapolis, Automobile Show....Nov. 6-13
Newark N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13
Pittsburgh, Pa., Automobile Show. Nov. 6-13
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Rochester, Automobile Show.....Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show. Nov. 14-21
Portland, Ore., Automobile Show. Nov. 14-21

SHOW BUSINESS

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Denver, Colo., Automobile Show, Nov. 15-20
Jersey City, N. J., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4
A.S.I. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

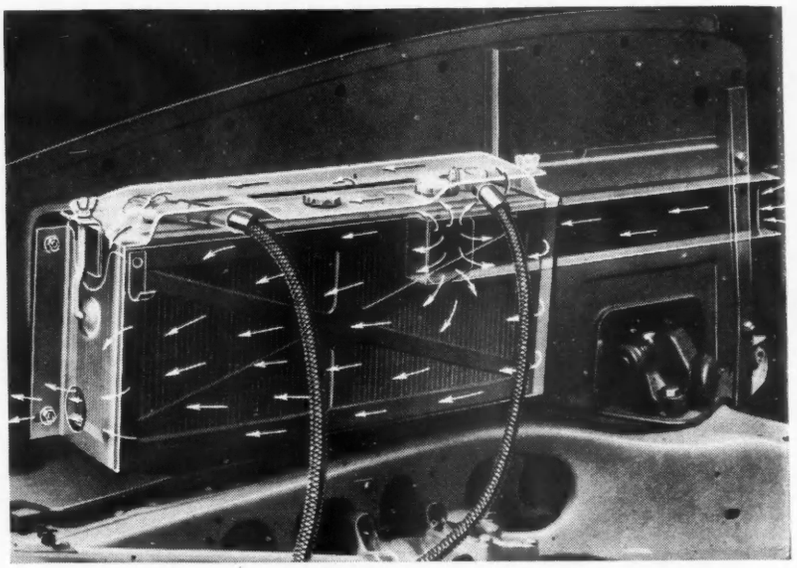
FOREIGN SHOWS

France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London...Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Montreal, Que., Automobile Show, Nov. 20-27
Peru, Automobile Show, Lima, Dec. 23-Jan. 6, 1938

CONVENTIONS AND MEETINGS

National Battery Manufacturers Asso., Chicago .....Oct. 10-12
National Safety Congress & Exposition, Kansas City .....Oct. 11-15
National Association of Motor Bus Operators, convention, Chicago, Oct. 13-14
National Metal Congress, Atlantic City, Oct. 18-22
National Machine Tool Builders Asso., Annual Meeting, Hot Springs, Va., Oct. 25-27
SAE Annual Dinner, Commodore Hotel, New York .....Oct. 28
American Foundrymen's Association, 2nd annual foundry conference, Iowa City.....Oct. 29-30
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
American Society of Mechanical Engineers, New York .....Dec. 6-10
SAE National Production Meeting, Flint, Mich. .....Dec. 8-10
SAE Annual Meeting, Detroit, Jan. 10-14, 1938
American Road Builders' Association, Cleveland .....Jan. 17-21, 1938

Two Oldsmobile Lines Go Into 1938 wi



The end to end cell arrangement in the batteries of the new Oldsmobile models is shown in this illustration.

THE Oldsmobile safety automatic transmission, which was illustrated and described in AUTOMOTIVE INDUSTRIES of May 29, 1937, is now offered as an optional feature on both the Six and the Eight. The installation now includes a small transparent, molded-plastic sector on the steering wheel, etched with letters indicating the gear position. This eliminates the somewhat cumbersome sector mechanism first used.

A new hood incorporates a shrouded and concealed louver. One side and half of the top of the hood are in one piece that is hinged along the middle, so that the whole engine can be completely exposed. Sheet metal splashers are made quickly detachable at the frame, to give free access to the valve mechanism for service operations, making it unnecessary to remove the front fender.

Lamps now are fender-mounted and braced securely by means of a cross member extending through the front sheet metal assembly. Lenses have been increased in diameter from 6½ to 7 in.

A Delco storage battery with end-to-end cell arrangement is carried in a sealed metal box on the hood ledge in the engine compartment. The sealed cover is readily removable for service operations. Cooling and ventilation of the box are effected by means of air entering through a duct from the front-apron louvers and escaping through a large hole in the rear wall.

Both the Six and Eight use the large front apron louvers to supply fresh air to the engine compartment outside of the radiator, as well as air for the battery.

Defroster outlets now are wide slots punched in the windshield garnish molding, permitting the heated air stream to impinge directly on the glass. Heated air is supplied by a deluxe heater with oversize blower for the defrosters.

Engines remain unchanged. The Six, with 3 7/16 in. bore and 4⅛ in. stroke (230 cu. in. displacement), is rated 95 hp. at 3400 r.p.m., with a compression ratio of 6. The Eight, with a bore of 3¼ in. and a stroke of 3⅞ in. (257 cu. in. displacement), is rated 110 hp. at 3600 r.p.m., with a compression ratio of 6.2. To meet an operating condition with the automatic transmission,

Oldsmobile Models for 1938

Six Series, 95 hp. engine,
117-in. wheelbase
3 7/16 in. bore, 4⅛ in. stroke, compression ratio 6

Eight Series, 110 hp. engine
124-in. wheelbase
3¼ in. bore, 3⅞ in. stroke, compression ratio 6.2

Body Types

Two Door Sedan
Two Door Touring Sedan with trunk
Four Door Sedan
Four Door Touring Sedan with trunk
Business Coupe
Club Coupe
Convertible Coupe

with Improved Design

the carburetor for the Eight is now fitted with a special vacuum-operated fuel nozzle which results in the production of a richer mixture during gear-changing intervals, when the engine speed tends to drop while the throttle is held substantially open. This attachment is standard on the Eight.

Of the minor refinements, the most significant are found on the lower support arm bearings. At the inner hinge point, that is, where the arm is attached to the front cross-member, a hardened bearing with oil-resisting synthetic rubber seals is provided. Oil-resisting rubber bushings are fitted also in the lower-support bearing at the knuckle, to provide a permanent oil seal.

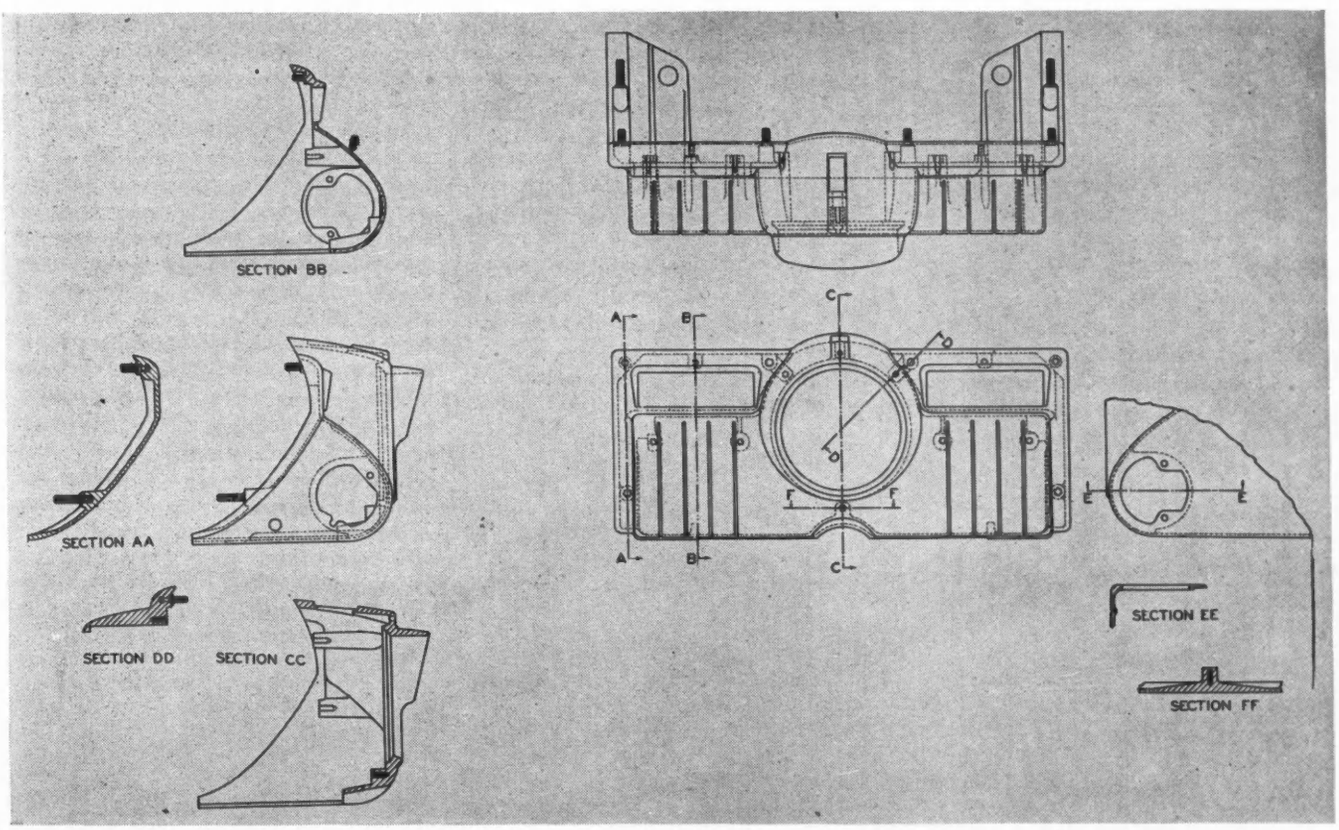
A new steering wheel on the Eight has only one spoke, in a horizontal position, with an arched member on each side. This affords good visibility of the instrument panel and an unusually secure grip on the wheel. This wheel is standard on the Eight, while on the Six it is supplied when the automatic transmission is specified. With automatic transmission, the steering column is fitted with the hand shifting lever and controls; also with a small sector indicating the gear positions.

The standard instrument panel is perhaps the largest and most intricate Bakelite molding made for automotive use. It is finished in a baked enamel to match the interior finish. The entire assembly is mounted on the left side, where it can be plainly seen through the wheel. It carries the speedometer in the center and the other instruments in pairs on opposite sides. The ends of the housing terminate in large plastic knobs. The left side is the light switch, the right side, the radio control. Other control knobs are mounted in a depressed section of the metal instrument panel, in the center, for safety.

As a further safety measure, the front seat is made with a soft roll at the top to afford safety to back seat passengers in case of accident.

In addition to the zinc die castings at the front end, the new cars feature a die-cast combination license-plate light and door handle on the rear deck.

Details of the instrument panel which is probably the largest and most intricate Bakelite molding made for automotive use.



Four Decades of M

By Captain Robert J. Icks, U.S.A.

THE first of the post war tanks was the Christie. It was planned originally as a dual-purpose chassis —truck and tank. However, in order to get quick delivery and early test, considerable in the way of concessions in decreased engine power, clearance, and accessibility of parts was made. Mr. Christie, as is well known, was an automobile racing driver years before and had developed numerous advances in the automotive field, among which was the first front-wheel-drive automobile. The concessions made in the Christie design were for the purpose of attempting to meet the Caliber Board specifications for a medium tank. During the war, considerable difficulty had been experienced in quickly concentrating tanks in any particular sector for a sudden attack. Rail transportation was not always available for the heavy tanks, and special trucks could not always be obtained for the light tanks. The combination of wheels and tracks in the Christie type was felt to be of decided advantage in meeting this problem. However, the first Christie had minor defects of manufacture and hasty assembly, the engine and transmission were inaccessible, there was practically no springing, and the tracks were badly designed. On the other hand, it possessed one feature never before or after achieved, it could operate forward or backward at equal speeds.

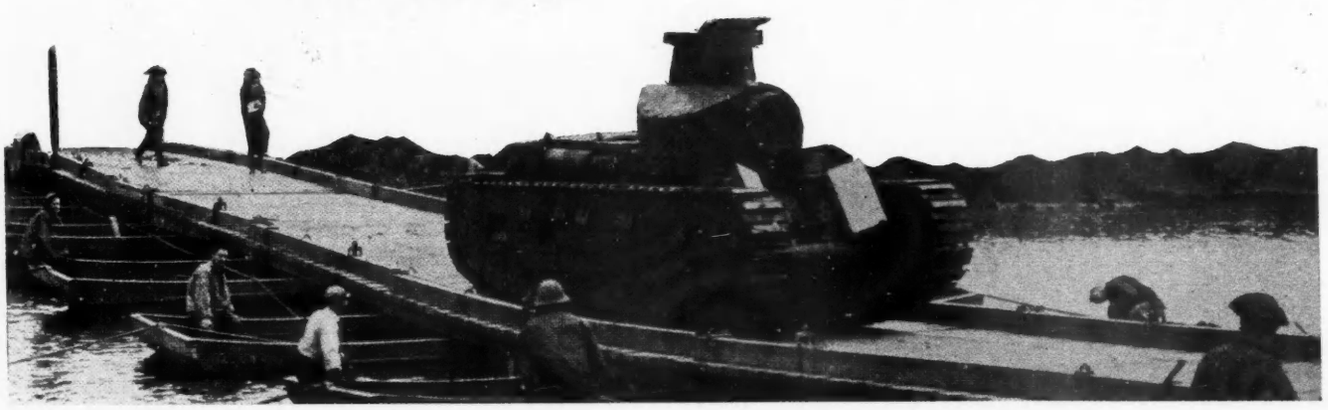
The Caliber Board was organized shortly after the war to lay down desirable policies in armament from our experience in the World War. The idea of this board in connection with tanks was to develop one tank—a medium—which would replace both the 6-ton and the Mark VIII types, combining in one the necessary characteristics of both. This was doomed to failure, because it is seldom possible to combine weapons of opposed or widely divergent characteristics. The War Department, however, approved the medium-tank project, fixed the weight at 15 tons and gave priority to the work of development. Specifications of the Caliber Board for a medium tank were met in part by the Ordnance Department in the medium A built in 1921 (Fig. 9), a good tank which had maneuverability, satisfactory armament, and a speed of ten miles per hour, but it was a specialized weapon. The original specifications required that the tank had to be able to cross a 9-foot trench, which meant a tank over twenty-one feet in length and also meant that two could not be loaded on one flat car—a waste of transportation space in the congested area of operations. The armor specifications provided for protection against caliber .50 armor-piercing projectiles. As a result, the actual weight of the tank grew from fifteen to twenty-three and a half tons. After it was completed, a new pontoon bridge supporting not over fifteen tons was adopted, and it was planned to build another smaller medium tank to come within this maximum.

The medium A was, therefore, considered unsatisfactory, and although the Christie could be tuned up to give a beautiful flash demonstration, it too was unsatisfactory. The Front Drive Motor Company rebuilt the 1919 Christie into the M1921 Christie, a tank which performed so well at first that the Tables of Organization were modified on the basis of eventual rearmament with these tanks. Mr. Christie then produced in 1921 his first amphibious tank, which could run on wheels, on tracks, or in water. Sometimes considered to be the first amphibious tank in the world it actually was second in this to the British medium D series. The following year the Christie amphibious tank was rebuilt and gave a remarkable demonstration in December 1922 in crossing the Hudson River at New York City. Further refinements were made, and the tank again was rebuilt in 1923. The Marine Corps observed the operation of this model but did not adopt it. It never was tested officially by our Government.

The Ordnance Department designed and built the 1922 medium tank, incorporating features from the medium A and adopting certain features from a British tank, the medium D. This British tank had been designed near the close of the World War for use in the German rear areas had the war gone on into 1919. It also was a good "flash" vehicle. Two features which we borrowed from this design were the flexible tracks with cable suspension and the track frames higher in rear than in front. Like the medium A, however, this tank was not the tank wanted by the Army. It was not as good a tank as the medium A.

In endeavoring to develop specifications for a divisional tank, the War Department laid down certain require-

Fig. 9—The medium A tank, 1921 crossing a pontoon bridge.



Mechanization in the U.S. Army

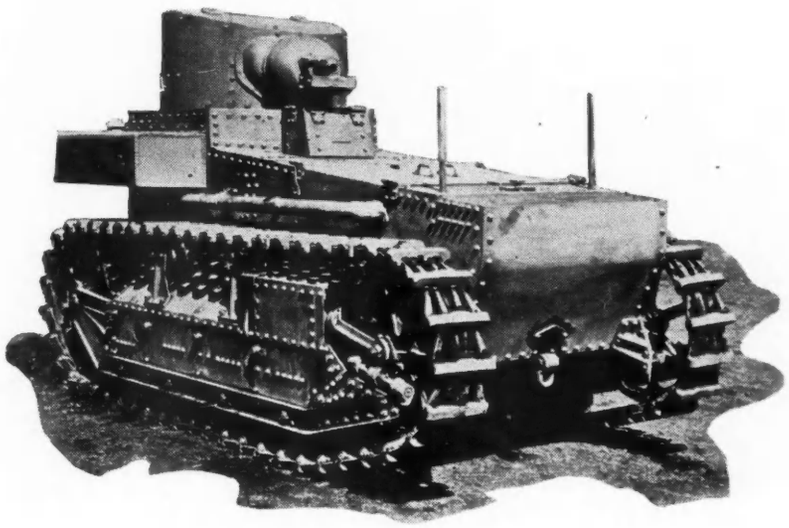


Fig. 10—The light tank T1-E1, 1927

ments about this time. The French had been testing the Kegresse track on their Renault tanks and had used tanks so equipped more or less successully in the Riff campaigns in Morocco. The Ordnance Department arranged the purchase of a complete track assembly and an extra track from Andre Citroën in France, intending to make such an installation on one of our 6-ton tanks. This was found to be impossible because of differences due to the metric system, and the change was made instead on an old Renault tank at Aberdeen under the direction of a French engineer and his mechanic. After completion in August 1925, the tank was tested. There was an increase in speed from five and a half to ten miles per hour and a considerable decrease in the noise of operation, but the low track mileage life and other defects led to our abandoning this project. During the same year, another medium tank, the T-1, was built at Rock Island Arsenal, very similar in appearance to the medium A. It was a considerable improvement on the two previous medium tanks but retained their major faults.

Interest in light tanks for infantry use revived in 1926. The Chief of Infantry received authority and submitted specifications for a light tank in January 1927. A fast, well-armed, dependable tank which could be carried on a commercial 5-ton truck was aimed at. The Ordnance Department collaborated with the Society of Automotive Engineers and drew up the designs which incorporated the latest automotive improvements, including a new type of springless suspension, known as the link type, in which shocks were intended to be equalized. Another feature was to build the chassis as an all-purpose one, reducing the difficulties of war-time procurement. Thus the tank chassis would serve also as a chassis for gun carriers, cargo carriers, etc. The first of this series of light tanks was the T-1 built by James Cunningham Sons and Company at Rochester, New York. The armament in these tanks was one 37-mm. cannon in a combination mount with a caliber .30 machine gun built to Ordnance Department drawings and specifications. The pilot model was demonstrated at Rochester in October 1927, and the changes required were incorporated in the succeeding model, the T1-E1 or Type 1 Experimental Model 1 (Fig. 10), which appeared in 1928. The Cunningham people also built in this year an experimental 1-man tank on Ordnance design. The British military press, beginning in 1925, had been featuring the 1-man tank idea because of the preliminary success of the Martel and Carden Loyd tankettes. Our 1-man tank was built partly to test such a design in this country but mainly to test a special type of flexible track which would be available in war time through modification of comercial band-saw steel.

The first scout car built after the war was the partially armored Pontiac or light T-1. This was really a reconnaissance car with bucket seats, carrying only an armored shield in place of the normal windshield. It had a crew of four and carried one machine gun beside the driver and a second one in the rear on an antiaircraft mount. This car was followed by the completely armored T-2 cars built on La Salle chassis. They had boxlike hulls with no turrets and were used principally on the Mexican Border. Each had a crew

Part 2

Part 1 of this article, with this concluding instalment, appears by special arrangement with *Army Ordnance*. The first instalment dealt with the development of mechanization up to the World War period. Part 2 tells of the work that has followed.

of four and carried one Thompson gun and one machine gun. The latter could be elevated above the level of the roof. Until this time the Cavalry had been interested mainly in armored cars for reconnaissance purposes, but there became apparent an interest in tanks. The 6-ton tanks provided in the Tables of Organization for the Cavalry division were far too slow to accompany rapid cavalry action. After the organization of the original Experimental Mechanized Force at Fort Meade, Md., for about three months during the summer of 1928, much more interest became apparent. This original mechanized force was organized for the purpose of formulating doctrine and determining the desirable types of automotive equipment. The British Mechanized Brigade had been publicized widely and the military press throughout the world emphasized the importance of this variation in warfare.

Mr. Christie had reorganized his company into the U. S. Wheel Tracklayer Corporation, and had designed a new tank which continued his basic idea of a convertible wheel-and-track tank. So extraordinary were the results achieved in the first tests in October 1928, that not only did military mechanization enthusiasts in this country advocate immediate adoption of this tank, but representatives of other nations made arrangements for purchase, as well. Five Christie tanks were ordered by the War Department.

In the meantime, the Ordnance Department in 1929 modified the T-2 La Salle armored cars by rebuilding the hulls in various forms and adding turrets of various kinds. A further model in the T-1 light tank series also was built during this year—the T1-T2. Minor defects in the T1-E1 were corrected but the major defects (*e.g.* engine in front of driver, rough riding and center of gravity too far back) were left uncorrected, the armor was thickened, and the engine horsepower increased. The light tanks of the World War period were intended for strategical transport on trucks because their life on tracks was short. The stamina shown by the T-1 light-tank series gave an indication that it might be possible to eliminate trucks as tank carriers with a resultant simplification of organization and supply. Since then, the goal has been to eliminate the use of trucks and to develop light tanks which are possessed of sufficient stamina and speed to possess their own strategical mobility. The Christie tanks first proved that this effect might be achieved. In 1930 one of the T1-E1 light tanks was modified by the Ordnance Department into the T1-E3 to provide a better suspension system than the link type used in the T-1 light-tank series. Rollers, bogies, and vertical coil springs within hydraulic shock absorbers formed the suspension change and materially improved the riding qualities.

All during this period, there had been differences of opinion between the using services and the designing service, or between the Infantry and Cavalry and the Ordnance Department. One of the principal grievances of the Infantry was the fact that in tanks of Ordnance design the engine was placed in front of the driver where heat and fumes were blown back; moreover, dead space for vision was too great. The Quartermaster Corps also took a hand in matters, and there was designed and built at the Holabird Quartermaster Depot near Baltimore an armored car on a special chassis and utilizing the Franklin air-cooled engine. While this was an excellent vehicle, its chief claim to fame lies in the fact that it was intended to be interchangeable with a truck body, thus simplifying war-time procurement. This armored car later became known as the T-7. The Holabird Depot also built some small armored cars on commercial Whippet, Plymouth, and Chevrolet chassis on the design of Col. Bruce Palmer of the Cavalry School. They were very simply in type, but each had certain features not possessed by the others. At the Cavalry School some experimentation was taking place with motorcycles armed with Thompson submachine guns. The first real armored car, however, was the T-4, Ordnance-designed and built by Cunningham. This is a 6-wheeled car in which the armored hull forms the framework, there being no chassis as such.

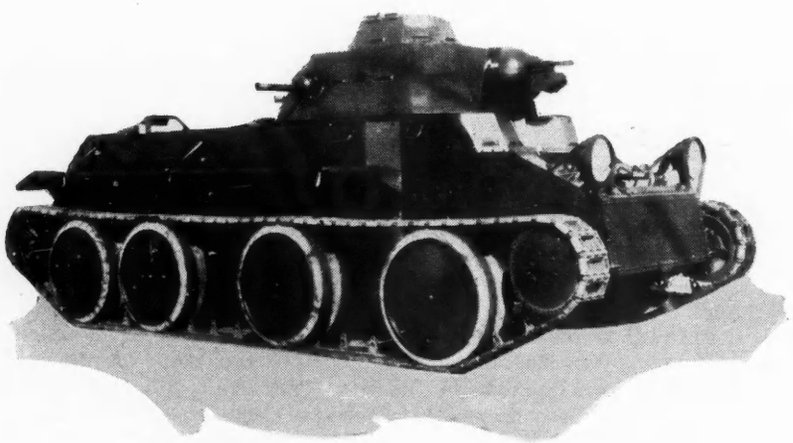


Fig. 11—The medium tank T3-E2, 1933

In 1930, through the efforts of Capt. George H. Rarey, instructor in charge of the light-tank section of the Tank School, arrangements were made to install a Franklin engine in a 6-ton tank, to modify the idlers because of the increased speed which would result, and to reduce the noise existent in operating these tanks. The water-cooling system in our light tanks, as well as in our heavy tanks, never had been satisfactory, and the Franklin engine gave promise of permitting a modification likely to prove practical in modernizing our existing light-tank equipment. The results justified the experiment, since the speed of the tank increased to ten miles per hour and the noise was reduced by at least fifty per cent. Due to the showing made by this modification, the War Department decided to modify six additional 6-ton tanks for the use of the Mechanized Force, which was our second experimental mechanized group, organized at Fort Eustis, Virginia, in 1930. The work was done at Fort Meade by the Ordnance shops and the tanks were delivered for use. A later Franklin engine was used, and other modifications were made in the cooling baffles. After delivery of the six tanks, the first one also was modified accordingly. These tanks were known as the 6-ton tank A-1. This development was later discontinued due to a decision of the Chief of Infantry to cease improvements to war-time tanks.

Although the three earlier medium tanks had failed to meet specifications, they continued in experimental use, but there came a definite change in viewpoint regarding the use of breakthrough, penetration, or leading tanks. It was decided that this type had an extremely limited sphere of usefulness, and that this sphere was largely imaginary and peculiar to Europe. The limitation of portable military bridges to

fifteen tons as mentioned previously, led to the development of a 15-ton medium tank known as the T-2 medium, first demonstrated in 1930. It was equipped with a Liberty engine and armed with a 3-pounder semiautomatic gun in a combination mount with a caliber .50 machine gun. The secondary armament consisted of a 37-mm. semiautomatic gun in a combination mount with a caliber .30 machine gun. The weapons were poorly mounted and the gunners interfered with one another in serving them. Theoretically, it had the greatest fire power of any of our tanks built up to that time. Actually, however, the secondary armament was practically valueless. Later, when the tank was rebuilt, it was eliminated.

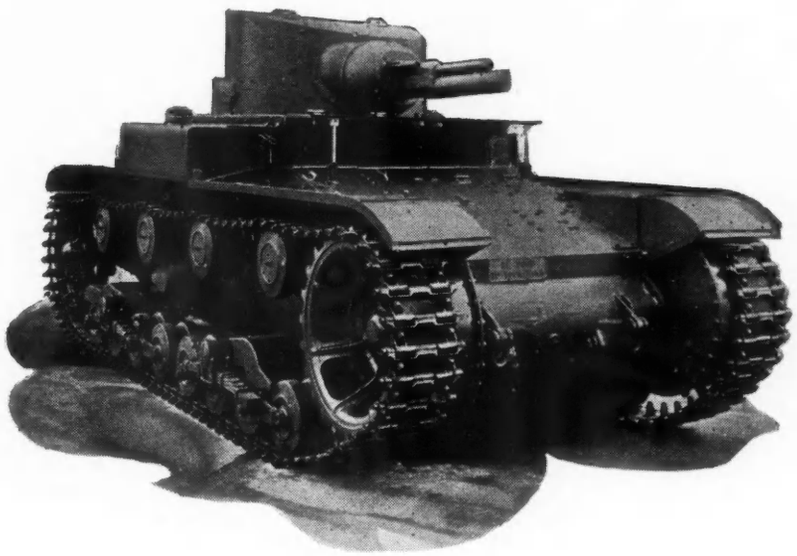


Fig. 12—The light tank T1-E4, 1932

Ventilation had been troublesome in some of our tanks, but this tank went to the opposite extreme. The intake was inside the crew compartment, and air was drawn in at such a terrific rate that the churning by the tracks of sandy or loos soil produced a veritable sand blast on the inside for the crew. It rode very roughly and was not well received by the Infantry.

General Douglas McArthur became Chief of Staff in November 1930, and almost immediately mechanization in our service received an impetus. It was the General who visualized the use of tanks by cavalry in supporting the unchanged cavalry mission, and it was then the term "combat car" was coined to designate a cavalry tank as distinguished from an infantry tank.

The Ordnance Department arranged with Vickers Armstrongs Ltd., of London, England, for a 30-day demonstration and test of the Vickers Armstrongs 6-ton "A" tank. This tank was, in general, similar in size and armament to the light tank T1-E3 and was intended to give valuable comparison data as to the relative merits of the two designs. The test was made in the summer of 1931 at Fort Meade, Md., and at the Aberdeen Proving Ground. It showed the superiority of the British tank over any light tank built in this country up to that time. Later, one of the T1-E1 light tanks was converted into the T1-E4 (Fig. 12). This tank reversed the hull so that the engine was in the rear, a feature which the Infantry had insisted upon, and rightly so. However, it failed to stand up under the strenuous tests provided for it, although it was a definite step in the direction of a suitable infantry tank. The medium T-1 tank was modified in 1931 by installing a Liberty engine in place of the special Packard engine used previously. With this change its designation changed to medium T1-E1. By lowering compression, the power of this engine was reduced forty-three horsepower, from 338 to 295 horsepower. The change decreased effectiveness.

Early in 1932 the Heat Controlled Motor Company of Minneapolis presented a proposal for applying their air-cooling system to the water-cooled Liberty engine for use in tanks. The Tank School at Fort Meade aided in obtaining a used Liberty engine for the experiment, and Capt. George H. Rarey, then instructor in charge of the Mark VIII tank course, was designated to represent the Tank School in this development. The project was completed and the air-cooled Liberty engine was turned over to the Aberdeen Proving Ground for test. After being tested in August 1932 in a Mark VIII tank, the report approved air cooling in principle and this modification in particular. However, during that year, the Mark VIII tanks of the World War period were pronounced obsolete and were placed in war storage because of the expense of operating them and their slow speed.

The contract for the Christie tanks previously mentioned was let in June 1931, and delivery of the first one was in September of the same year. These tanks, as delivered, were provided with simulated armor. The armament and

Fig. 13—The Christie T3 medium tank, 1931

engines were furnished by the Ordnance Department. The cost of each tank delivered (without armor, engines, guns or radios) was $34,500. The Mechanized Force at Fort Eustis, Virginia, was disbanded in 1932. Part of its personnel and equipment became the nucleus for a mechanized cavalry unit called The Detachment, 1st Cavalry (Mechanized) which was organized in July 1932 at Fort Knox, Kentucky. Later, this became the 1st Cavalry (Mechanized), the forerunner of a two-regiment mechanized cavalry brigade. The setting up of this organization and its purpose is indicated in the instructions issued by the War Department at the time: "The mechanization of one regiment is the first step in determining the application of modern machines to cavalry missions in war . . . without, however, altering the accepted fundamental missions of that arm." With the delivery of the Christie tanks, some of which went to the Infantry and some to the Cavalry, different designations were used. In the Infantry they were called T-3 medium tanks (Fig. 13), whereas in the Cavalry the chain-driven models were called T-1 combat cars and the gear-driven model was called the T-3 combat car.

Another of the T1-E1 tanks was rebuilt at Aberdeen Proving Ground in 1932. The principal change was the installation of the Cletra controlled differential which permitted the transmission of power to both tracks at all times. This modification became known as the T1-E5. In 1933 the T1-E4 light tank also rebuilt. A La France engine of 240 horsepower replaced the previous 150 horsepower engine, the hull was raised, and ventilation improved, but it was not satisfactory. It was tail-heavy, among other faults. Collaboration between the Infantry and the Ordnance Department resulted in specifications for new medium tanks of the Christie type. Mr. Christie had not furnished blueprints of the original T-3 medium tanks whose parts were found to be not interchangeable, and it was necessary to measure the vehicles and make adjustments in order to make drawings. Then the new drawings and specifications were prepared and bids were requested. The contract for several of these was let to the lowest bidders—American La France and Foamite Company. Delivery was made in 1933 of these tanks known as the T3-E2 mediums. Armament in the tanks was based on the combined use of caliber .30 guns and 37-mm. guns. After delivery of the T3-E2 mediums (Fig. 11), the previous medium tanks and the T-1 light series were declared obsolete and placed in the Ordnance museum.

During the latter part of 1934, a special test on cooling the 6-ton tanks was made at Fort Benning. Later the Ethyl Gas Corporation collaborated in furnishing certain equipment for use in the Buda engine to raise the compression ratio from 4 to 1 to 5.2 to 1. The result was an increase in power. The tank was successfully cooled at last, but shortly after this, all the 6-ton tanks were placed in war storage.

All of the above deals with the vehicles in which the Army is or has been interested primarily. However, several of the firms which have built these vehicles for the Army now have produced commercial designs. The vehicles produced in recent years in this country in Ordnance Department design unquestionably are superior to their previous models but we have come over a long, difficult and devious road to achieve this result. However, the using and manufacturing services each are giving their best efforts toward solution of the many difficult problems connected with the procurement of satisfactory types of these very important combat vehicles.

AUTOMOTIVE ABSTRACTS

(Continued from page 478)

increase in specific output was accomplished. Many will say that it was due chiefly to improvements in fuels, and while this is true to a large extent, the engine itself had to be greatly improved to enable it to withstand the severer duty.

Of all the many components in which a weakness may cause the breakdown of the engine, there are two which remain, perhaps, the major preoccupation of the designer, namely, the piston and the crankshaft and its bearings. The problems of the piston are chiefly thermal, those of the crankshaft mechanical. The ability of piston materials to maintain the necessary strength at high temperatures has undoubtedly been improved during the past five years, nevertheless it was necessary to thicken piston crowns in order to assure an adequate rate of heat flow, and to put up with the resulting increase in weight. Any new material of specific gravity not over 3.00 and of a thermal conductivity not less than that of Y alloy, which at the same time maintains its mechanical properties better than Y alloy at temperatures above 575 deg. Fahr. would be of major importance to the aircraft engine of the future.

Sodium-cooled exhaust valves with Stellite facings are now becoming universal in high-duty engines, but even this complex design does not cure all of the troubles, and there is evidence of a rapid increase in the rate of attack even on Stellite, in the presence of lead oxide, between 1100 and 1300 deg. Fahr. and again above about 1650 degs. Fahr. The practice of covering the whole top surface of the valve with Stellite to prevent scaling led to trouble owing to the difference in the coefficients of heat expansion of Stellite and steel. The Stellite cracks and the entire covering disintegrates in from 50 to 100 hours of high-duty running. For this reason a new material composed of about 80 per cent nickel and 20 per cent chromium was tried for the purpose. A possible further development is the manufacture of the entire solid part of the valve of this non-ferrous alloy, to avoid the difficult welding operation.

By examination of some new and some used aircraft cylinder, Prof. Finch found that the "running-in" process between the piston and the cylinder results in an extremely thick Beilby layer being formed, so thick that several rubbings with fine emery paper were necessary to remove the fine amorphous layer and reexpose the crystalline substratum. One of the substances investigated which exhibited a stable amorphous layer after polishing was spinel, a magnesium aluminate with aluminum oxide in solid solution, and Prof. Finch suggested that if a suitable oxidized magnesium-aluminum alloy surface were used, it was possible, by polishing this, to form spinel with a permanently amorphous and therefore smooth Beilby layer. The usual aluminum alloys used for pistons, on the other hand, become spontaneously covered with a thin layer of very hard aluminum oxide. This oxide layer can be made amorphous, but Prof. Finch's observations indicate that during the running-in process the oxide layer, instead of settling down into a smooth, amorphous bearing, becomes converted into a layer of minute sapphire crystals. It has long been known that cylinder barrels wear more rapidly with aluminum than with iron pistons, in spite of the greater softness of the former. Hitherto it was supposed that this is due to the embedding of abrasive particles in the soft aluminum, but Prof. Finch's explanation that aluminum forms its own abrasive surface with sapphire teeth is not only more picturesque but probably also more true.—*Engineering*, Sept. 10.

Paraffin Hydrocarbons Isolated from Crude Synthetic Isooctane

In 1934 the Cooperative Fuel Research Committee requested the National Bureau of Standards to develop specifications for normal heptane and for the isooctane (2, 2, 4-trimethylpentane) which are used as primary standards of reference for the knock rating of automotive fuels.

In carrying out the investigation of the isooctane, over twenty isoparaffins were obtained in a relatively pure state. Some of these compounds have not been described previously, and several others are decidedly purer than previous preparations.

The materials were isolated by fractional distillation through columns

(Turn to page 497, please)

Just Among Ourselves

Calm Appraisal Of the Trailer

WE have just read with intense interest an article on the tourist trailer industry written by Philip H. Smith for our issue of Oct. 23. Previews are in harmony with the season, so we're going to give you a sentence from the article. "Nineteen thirty-seven," says Mr. Smith, "will be known as the year of the great shake-down in the trailer industry." The hows, whats and whys of the main part of the article seem to us to be a masterly analysis of his thesis. The trailer industry has suffered from romantic drool written about it, as well as from the Jeremiads of disappointed owners. Calm appraisal has been rare. We present it with some pride in our Oct. 23 issue.

A Questionnaire On Speed Limits

PERHAPS the broadest effort ever made to determine safe operating speeds for motor vehicles is being undertaken currently by the Section of Safety of the I.C.C.'s Motor Carrier Bureau. A comprehensive questionnaire to "representative motor carriers" in every state seeks the answer to such things as the influence of governors on the accident rate, the effectiveness of instruction to drivers, of throttle stops, recording speedometers and other efforts to control the speed of trucks on the road. Eventual results of the questionnaire may be, of course, I.C.C. regulations governing the maximum and conditional speed of vehicles under its jurisdiction. To such a result we are not prepared to give unqualified approval, but the method of approaching the problem has much to commend it.

Says the commission, in a memorandum accompanying the questionnaire: "At the time of promulgating its initial Motor Carrier Safety Regulations, this commission found it advisable, in the absence of adequate data or unified opinion among competent authorities, to refrain from fixing a maximum speed limit in miles-per-hour for the motor vehicles under its jurisdiction."

The memorandum distinguishes clearly between two types of excessive speed; that which is too fast for particular road conditions, and limiting, or maximum permissible speed.

The questionnaire seeks light on both questions from the actual experience of fleet operators, chiefly those who are large enough to maintain competent records.

The spirit of the inquiry is judicial and scientific. It should shed a great deal of light on the speed problem as it affects and is affected by all kinds of motor vehicles. What comes out of the inquiry in the way of regulations, we hope, will be in full accord with the spirit of the inquiry.

Foreign Car After American Dollars

ONE of the phenomena of minor interest this year has been the effort of several European automobile manufacturers to get a profitable foothold on the American market. None of them are expecting volume comparable with volume as we think of it, but one or two plan a respectable bid for what looks like volume to a European producer. When the facts are available, they will be presented in the news section.

A Long, Long Time

THE Philadelphia Automobile Show, to be held Nov. 6 to 13, will be the thirty-seventh annual. Show Manager Bill Berrien claims this as a record for any city in the country. Any back talk?

More Interest Less Time

AND speaking of shows, when the International Highway Congress met last July it got a good dose of American showmanship through the agency of Al Reeves, vice-president and general manager of the Automobile Manufacturers' Association and manager of the National Automobile Show in New York. Long-winded theses by many speakers were quite a strain for many of the delegates. So Al and George Bauer, A.M.A. export manager, told their story with lantern slides and pictures in just 18 minutes. The delegates were interested, and after their interest was aroused, they got the complete story in mimeographed form to take home.—H. H.

Factors Influencing the Durability of

By J. O. ALMEN*
and J. C. STRAUB†

THE methods for calculating stress in helical automobile transmission gears used for fatigue chart, Fig. 1, and for spiral bevel gears used for fatigue chart, Fig. 4 (see also "Factors Influencing the Durability of Spiral Bevel Gears" AUTOMOTIVE INDUSTRIES, Nov. 16 and Nov. 23, 1935) are described below. The term "bending stress" used in these descriptions is not to be interpreted as actual bending stress, but as a figure proportional to the true stress which gives a measure of the endurance strength in terms of the design factors. The justification for the use of these methods of stress computation lies in the fact that the bending stresses so-called, when plotted on logarithmic graph paper against the actual life of many failed gears, give a straight line, from which it follows that the life of such gears can be predicted with reasonable accuracy.

* Head of Dynamics Department, General Motors Research Laboratory.
† Research Engineer, Dynamics Department, General Motors Research Laboratory.

Fig. 11 (*A*) shows a gear in the virtual plane, that is, the plane of rotation. However, this method of calculating the bending stress on helical gears involves a layout in the normal section which is represented by a plane through *G-G'*, Fig. 11 (*B*). This is a plane normal to the tooth as shown by the section *G-G'*, Fig. 11 (*C*).

PR_n, Fig. 11 (*C*), is the pitch radius at the point P in the normal section and is given by

$$PR_n = PR_v \div \cos^2\Delta,$$

in which

PR_v = pitch radius in the plane of rotation, Fig. 11 (*A*).

Δ = helix angle at the pitch circle, Fig. 11 (*B*).

In the normal section, Fig. 11 (*C*), the base radius, *A*, is determined by the expression

$$A = PR_n \times \cos\alpha$$

α = normal pressure angle.

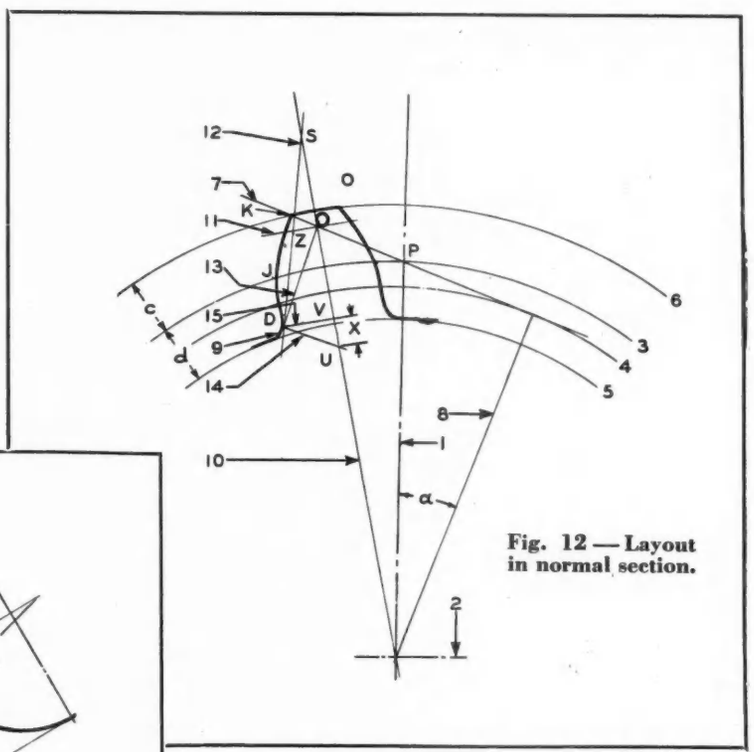


Fig. 12 — Layout in normal section.

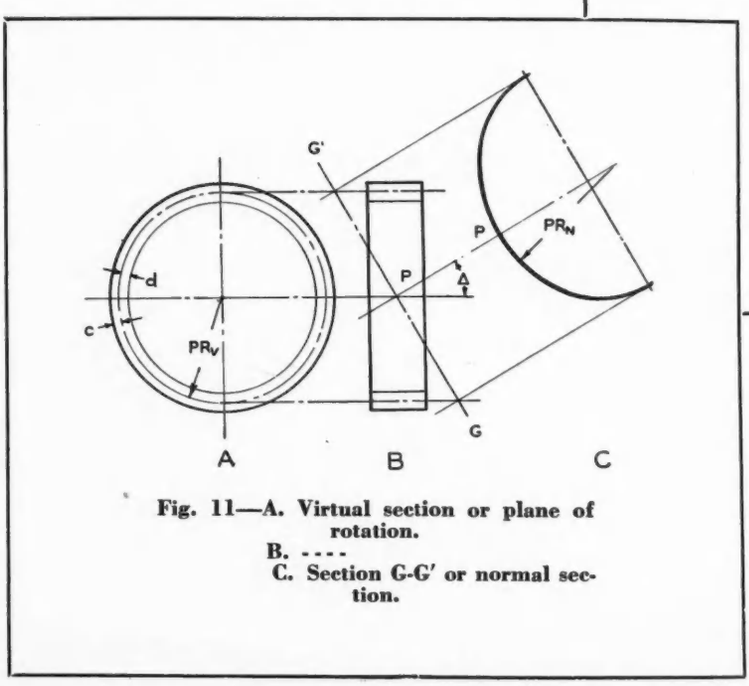


Fig. 11—A. Virtual section or plane of rotation.
B. ----
C. Section G-G' or normal section.

c and *d* are addendum and dedendum, respectively, as shown in Fig. 11 (*A*). They are unchanged when referred to the normal section.

Fig. 12 shows a layout in the normal section, the same as Fig. 11 (*C*), drawn to an enlarged scale. The construction lines are drawn in the order of the

# of Automobile Transmission Gears

Part 2 *Part 1 began in September 25, 1937 issue of* Automotive Industries *on page 426*

small numerals in Fig. 12. The scale of the layout is made as large as is practical.

(1) and (2) = center lines of the gear.
(3) = pitch circle whose radius = PR_n
(4) = base circle whose radius = A
(5) = root circle whose radius = $PR_n - d$
(6) = addendum circle whose radius = $PR_n + c$
(7) = line of action
(8) = normal to the line of action

The stress is computed with the load applied at the tip of the tooth. Consequently, the intersection K of the line of action with the addendum circle is the top of a tooth flank. The involute profile of the tooth is shown in Fig 12 for the purpose of illustration.

In order to determine the maximum stress in the tooth, it is necessary to construct the fillet (9). The fillet is generated by rolling the cutter rack on the pitch circle of the gear. Fig. 13 shows the process of generating the fillet. The initial position of the rack is shown in heavy lines. The successive positions of the rack are obtained by a slight rotation of the rack pitch line about the point of tangency. The accuracy of the entire calculation depends on the accuracy with which this fillet is generated. After generation, the fillet is drawn by connecting the points marked by (*H*) on the layout.

Referring again to Fig. 12, from the point *J*, half of the tooth thickness at the pitch line is laid off, and the tooth centerline 10 is drawn.

Through the intersection *O* of the tooth centerline and the line of action, the normal 11 is erected. The point of maximum stress is now found by drawing the line 12 tangent to the fillet and cutting the line 11 at *Z* and line 10 at *S*, such that $DZ = ZS$. The point of tangency *D* is the point of maximum stress. From this point *DV* is drawn normal to the centerline 10. *OD* is drawn and *DU* is drawn normal to *OD*. *UV* is then the *X* factor used in the stress equation:

$$S = \frac{3\pi T}{N \times F \times N_a \times X}$$

in which

S = bending stress on the tooth
T = applied torque on driving gear, in lb-in.
N = number of teeth in driving gear
F = face length of gear being calculated
N_a = length of action in the plane of rotation (see Fig. 14). This is not in the plane of the layout shown in Fig. 12
$N_a = \sqrt{OR^2_{pv} - PR^2_{pv} \times \cos^2\phi} - \sqrt{OR^2_{gv} - PR^2_{gv} \times \cos^2\phi} - (PR_{pv} + PR_{gv}) \sin\phi$
OR_{pv} = outside radius of pinion in the plane of rotation
PR_{pv} = pitch radius of pinion in the plane of rotation
OR_{gv} = outside radius of gear in the plane of rotation
PR_{gv} = pitch radius of gear in the plane of rotation
ϕ = pressure angle in the plane of rotation
$\tan\phi = \tan\alpha \div \cos\Delta$
X = tooth-form factor from layout = *UV* (Fig. 12)

The stress on the mating gear is calculated in the same way.

If one gear is appreciably wider than its mate, it has been found satisfactory to consider it a maximum of ⅛ inch wider than its mate.

In cases where the ends of the teeth are chamfered, the chamfer is neglected.

Note that in the procedure that has been followed, only the point *J* on the gear tooth flank has been used. Hence there is no need to draw the involute. Point *J* can be located during the generation of the fillet by marking the point where the flank of the rack tooth passes through the point of tangency of the pitch lines of the gear and rack.

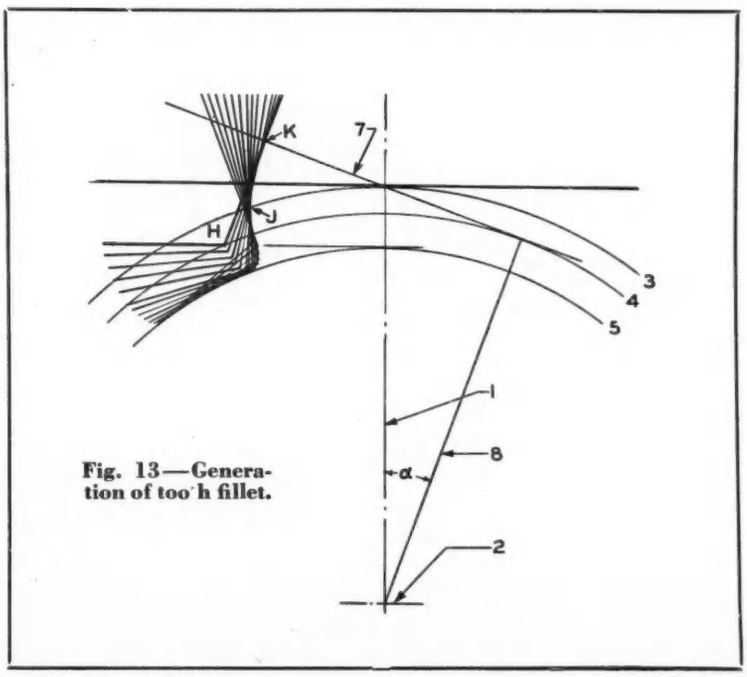


Fig. 13—Generation of tooth fillet.

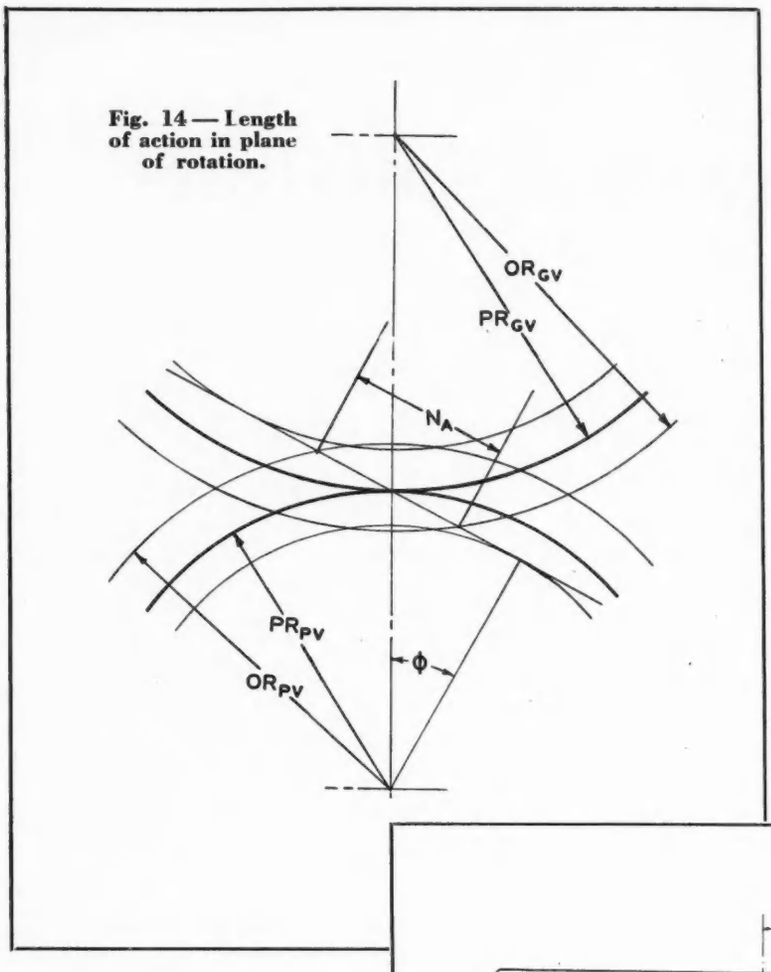


Fig. 14 — Length of action in plane of rotation.

$R_p = \frac{N_p}{N_g} R_g$

N_p = number of teeth in pinion

N_g = number of teeth in gear

F = face length of gear and pinion, in.

β = pitch cone angle of pinion

$\tan \beta = \frac{R_p}{R_g}$ or $\tan \beta = \frac{N_p}{N_g}$

L = pitch cone distance

$L = \frac{R_p}{\sin \beta}$ or $L = \frac{R_g}{\cos \beta}$

It can be seen from Fig 15 (*A*) that the center of the gear pitch line in the virtual section lies at the intersection of the gear axis with the line *C-C'* extended. With bevel-gear ratios common to automobile practice, the virtual pitch radius of the gear is so much greater than that of the pinion that the gear is considered to be a rack.

Fig. 15 (*B*) is a projection showing the virtual section in which the layout is made. In this layout, the pitch radius is equal to the back cone distance of the pinion. This radius is:

$R_{pv} = R_p \div \cos \beta$

In making the layout, it is necessary to determine the following dimensions in the virtual section:

Virtual pressure angle, ϕ

Base radius of the pinion in the virtual section, A_{pv}

Circular pitch, P

Addenda and dedenda of gear and pinion

$\text{Tan } \phi = \tan \alpha \div \cos \Delta$

α = normal pressure angle

Δ = spiral angle

$\div 8$ $A_{pv} = R_{pv} \cos \phi$

$P = \frac{2\pi R_p}{N_p}$

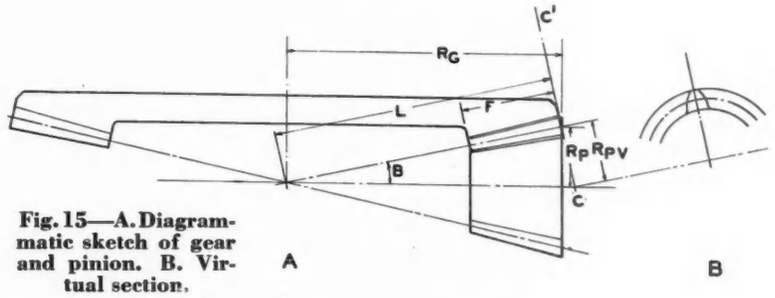


Fig. 15—A. Diagrammatic sketch of gear and pinion. B. Virtual section.

If the tooth thickness is given at a position other than at the pitch line, a short section of the tooth flank can easily be drawn by striking an arc through the point *J*, using as a center the point of tangency of a line through *J* tangent to the base circle.

In this method of computing the stress on helical gears, the load is assumed to be distributed uniformly on all teeth in contact.

The method of computing the bending stress on spiral bevel gears used for the fatigue chart, Fig. 4, involves a layout in the virtual section of the gear and pinion. Although the layout is in reality made in the mean virtual section, that is, the virtual section through the middle of the gear face, it will be found that by using the dimensions at the large end of the pinion, the calculation can be made much shorter. The final result is exactly the same, the only difference being in the scale of the layout, which, after all, is arbitrary. It must be understood, of course, that all dimensions used are taken at the large end, except the spiral angle. Usually, the dimensions are given at the large end, except tooth thickness, which must be converted to the large end. This can easily be done by the method described later. To avoid confusion, the layout is referred to as being at the large end of the pinion. In Fig. 15, the virtual section passes through the line *C-C'*, and is normal to the plane of the paper. *C-C'* is normal to the coinciding elements of the gear and pinion.

Referring to Fig. 15 (A):

R_g = normal pitch radius of gear at the large end

R_p = normal pitch radius of pinion at the large end

The circular pitch, addenda and dedena, are unchanged when converted into the virtual section.

A convenient method of laying out the involute profiles of the pinion tooth is to use an involute template. The template is generated from an arbitrary base circle (say 10 inch base radius) and can be used for practically any spiral bevel layout.

In order to convert the scale of the layout into the scale of the involute template, it is necessary to divide the base radius of the involute template by the virtual base radius of the pinion to be calculated. This gives the magnification factor, M.

$$M = \frac{\text{Base radius of template}}{A_{pv}}$$

All the dimensions of the layout must be multiplied by this magnification factor to convert them into the scale of the layout.

Fig. 16 shows a layout of the gears shown in Fig. 15. All of the dimensions are the same as in the projection in Fig. 15 (B) except that they have been enlarged by the magnification factor, M. The construction of the lines in the layout is made in the order of the small numerals in Fig. 16.

(1) and (2) = center lines of the pinion
(3) = pitch circle whose radius = R_{pv}
(4) = base circle whose radius = A_{pv}
(5) = root circle of pinion whose radius = R_{pv} − dedendum of pinion
(6) = addendum circle of pinion whose radius = R_{pv} + addendum of pinion
(7) = line of action
(8) = normal to the line of action
(9) = root line of gear
(10) = pitch line of gear
(11) = addendum line of gear

The position of the teeth is determined by the intersection G of the line of action 7 and the addendum line of the gear, 11. This point is the beginning of action, or the point at which one pinion tooth is just starting to share the load with the preceding tooth. The flank 12 of the gear rack is now drawn through G, normal to the line of action. The distance to the next rack tooth flank, 13, is equal to the circular pitch measured along the pitch line 10 of the rack.

Now it is necessary to know something about the thickness of the teeth. A convenient way of finding tooth thickness is to use the width of the tip of the gear cutter. This dimension is usually given on the detail print of the gear. It is referred to as "spread" or "finishing tool point width". Let us call it B_1. From this dimension the width of the gear tooth space at the root of the tooth is found. Since the dimension is given as of the cutter, it is normal to the tooth, and consequently it must be converted into the virtual section. Fig. 17 shows a diagrammatic view of a portion of the gear showing a tooth space at the root. The normal width of the space is shown as B_1. In the virtual section the width of this space is B_2.

$$B_2 = B_1 \div \cos \Delta$$

This gives the width of space at the middle of face or mean virtual section. Since the layout is made at the large end, this thickness must be transferred to conform with the other dimensions. This is done by increasing the space proportional to the distance from the apex.

The space at the large end then becomes:

$$B = B_2 \times \frac{L}{L - \frac{F}{2}}$$

or, in terms of B_1 :

$$B = \frac{B_1}{\frac{(1 - F)}{2L} \cos \Delta}$$

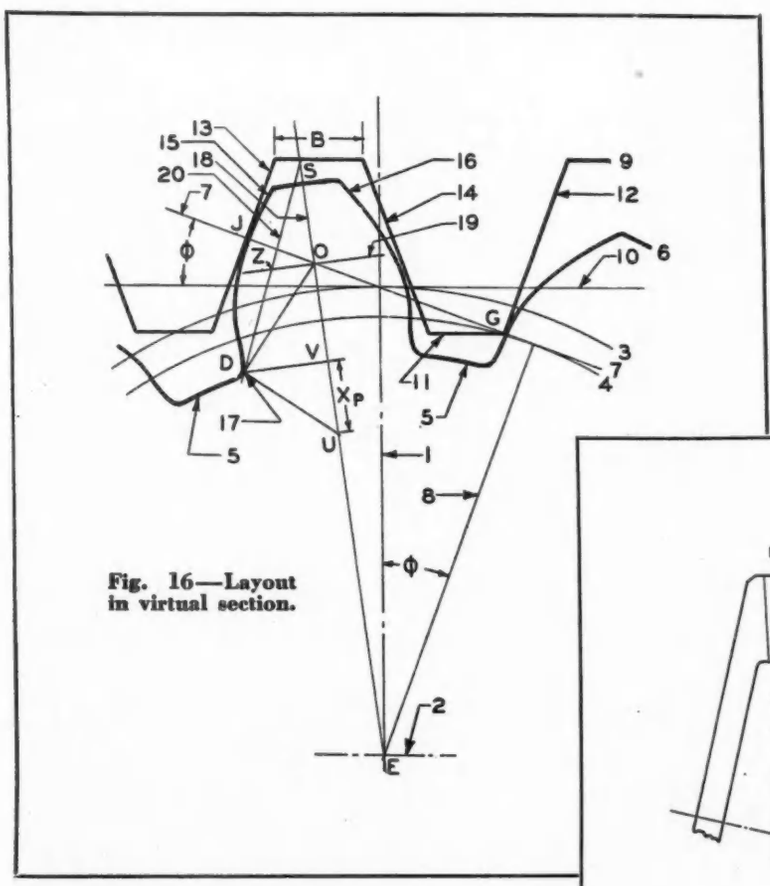


Fig. 16—Layout in virtual section.

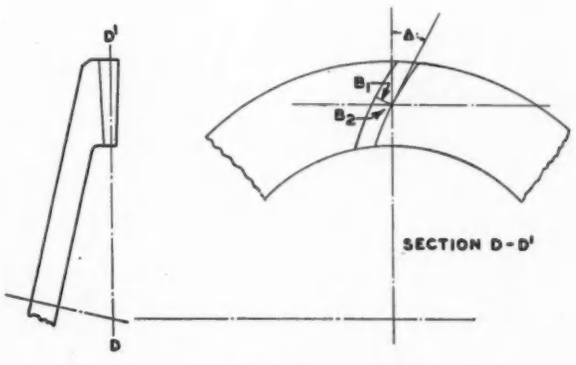


Fig. 17—Conversion of gear tooth space into virtual section.

This dimension, after being converted into the scale of the layout, is laid off at the root of the gear rack as shown in Fig. 16. The opposite side of the gear tooth space, 14, is now drawn.

The contracting flank 15 of the pinion tooth is drawn tangent to the gear tooth flank 13 at J, where the line of action crosses it. Then the other side of the pinion tooth, 16, is drawn, allowing for backlash.

In order to determine the point of maximum stress in tooth 15-16, it is necessary to construct the fillet 17. The fillet is generated by rolling the cutter rack on the pitch circle of the pinion. Fig. 18 shows the process of generating the fillet. The cutter rack is the same as the gear rack, except that the end of the cutter rack tooth extended is tangent to the root circle of the pinion. The initial position of the cutter rack is shown in heavy lines. The successive positions of the rack are obtained by a slight rotation of the rack pitch line about the point of tangency. This must be done with care, because the accuracy of the entire calculation depends on the accuracy with which this fillet is generated. After generation, the fillet is drawn by connecting the points marked by *H* on the layout.

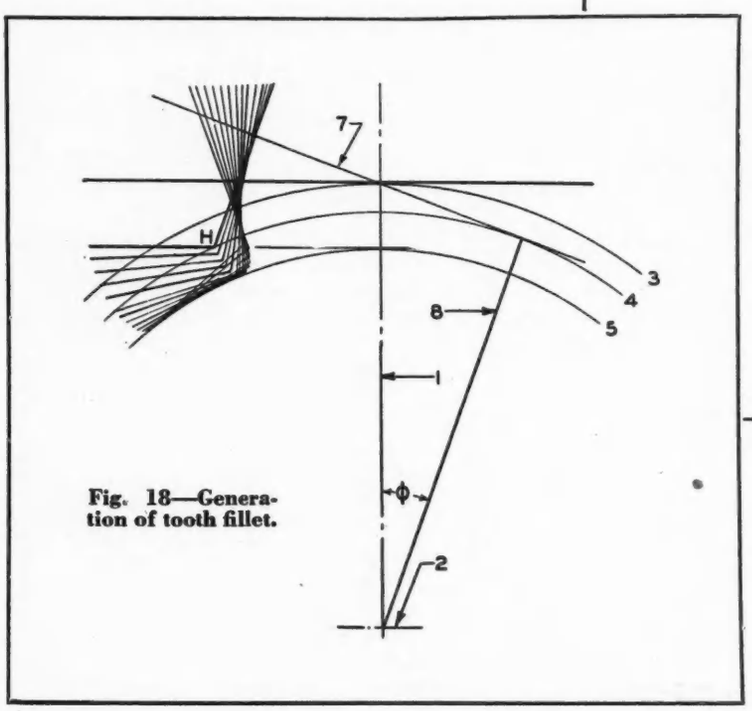


Fig. 18—Generation of tooth fillet.

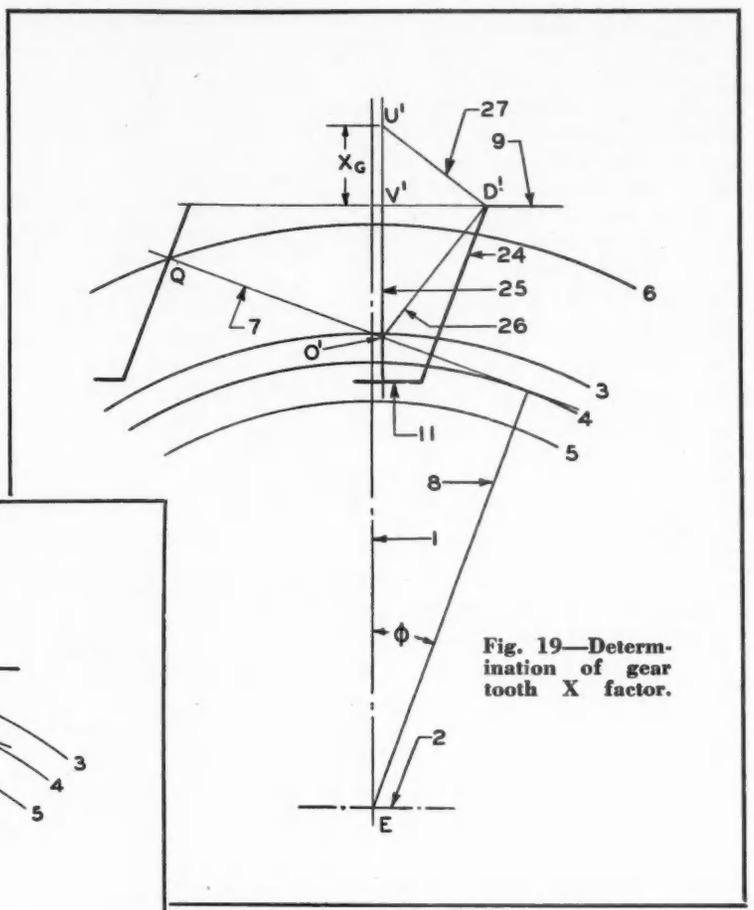


Fig. 19—Determination of gear tooth X factor.

Referring again to Fig. 16, the centerline 18 of the pinion tooth is now drawn, and through its intersection *O* with the line of action, the normal 19 is erected. The intersection point *O* is the point of application of the load on the tooth centerline.

The point of maximum stress is now found by drawing the line 20 tangent to the fillet and cutting the line 19 at Z and 18 at S such that DZ = ZS. The point of tangency D is the point of maximum stress. From this point DV is drawn normal to the centerline 18. OD is then drawn, and DU is drawn normal to OD. UV is then the X factor used in the stress equation:

$$S_p = \frac{1.5\ W_p}{F \times N \times X_p}$$

in which,

W_p = applied load at the point of application, *O*

$W_p = \dfrac{T}{R}$

T = applied torque on pinion in lb-in.

R = radius to point of load application, converted into the normal plane

$R = OE \times \cos \beta$

OE = distance from center *E* to point of load application *O*

F = face length, in.

N = modification factor for distribution of tooth load for spiral bevel gears

$$N = 1 - \frac{F}{L} - \frac{F^2}{3L^2}$$

X_p = tooth form factor taken from lay-layout

The stress on the gear tooth is calculated on the same basis as that of the pinion tooth, and the *X* factor can be found by using the same layout. Fig. 19 shows the construction for finding the *X* factor. For the purpose of illustration, the construction lines for the pinion stress have been eliminated, but no difficulty should be encountered in the actual layout with all construction lines intact. The position at which

one tooth ceases sharing the load is found by the intersection Q of the line of action with the addendum circle of the pinion. The stress is calculated on the next tooth, the contacting flank of which is at a distance of one normal pitch from the point of intersection Q along the line of action. The normal pitch is JG in Fig. 16 and can be transferred to the new position, using a pair of dividers. The tooth flank 24 is drawn normal to the line of action, and cutting the root line at D'. $D'V'$ is made equal to half the tooth thickness at the root, which can be scaled from the gear tooth as shown in Fig. 16.

The centerline 25 of the tooth is now drawn, intersecting the line of action at O'. $O'D'$ is then drawn and $U'D'$ normal to it. $U'V'$ is the X factor for the gear.

The stress on the gear is

$$S_g = \frac{1.5\ W_g}{F \times N \times X_g}$$

The load Wg on the gear tooth is equal to the tangential load at the pitch line, or

$$W_m = \frac{T}{R_p}$$

In some cases, where the gear has a large pressure angle and long teeth, the maximum stress is not at the root of the tooth. The stress is maximum at the point where the tooth thickness is twice the thickness of the tooth at the point of load application on the tooth centerline. If this point falls deeper than the root, of course, the maximum stress is at the root.

In this method of computing the stress on spiral bevel gear teeth, the load is assumed to be carried by one tooth. This is in contrast with the foregoing stress calculation on helical gear teeth, in which the load is assumed to be distributed uniformly on all the teeth in contact.

TOOLS OF TOMORROW

(Continued from page 477)

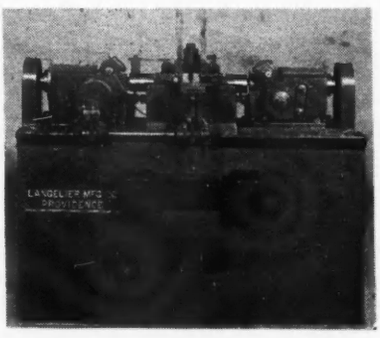
imum swing over table, 14 in.; maximum length between centers, 12 in. The following apply to the Bowgage wheel head: maximum feed on diameter, 0.125 in.; rapid traverse may be set at factory from 0 to 5 in.; range of grinding feed rates, infinite; dwell or spark-out time, 0-35 sec.; wheel sizes available, 24 by 2 by 12 in. and 20 by 4 by 12 in.

Threading

. . . double end Langelier machine for threading door knob spindles

The double end threading machine set up for threading door knob spindles which is shown in the accompanying illustration is a product of the Langelier Mfg. Co., Providence, R. I.

Operation is as follows: parts are loaded into a vertical magazine and shifted to the operating station by means of a cam actuated by the left hand unit. This unit also has a cam actuated device for clamping the part during the threading operation. The right hand unit is started in operation automatically by a limit switch on the left hand or control unit which closes a circuit to actuate a solenoid. This trips the clutch mechanism and the head makes one complete cycle, then stops. Self-opening die heads are used on the spindles, and after the operation is completed the parts are ejected automatically.



Langelier double end threading machine.

Tapping

. . . machine has five operating speeds ranging from 385 to 2240 r.p.m.

A new tapping machine has been announced by the Procunier Safety Chuck Co., Chicago. It has five operating speeds which range from 385 to 2240 r.p.m. Two interchangeable tapping heads afford a capacity ranging from No. 8 tap to ⅝ in. inclusive.

A special arrangement of long helical springs, adjustable over a wide range, maintains preset tapping and reversing pressures independent of the operator. Automatic, continuous lubrication of the tap is supplied only during tapping. By means of convenient timing and volume adjustments, lubrication can be set to give correct volumes, as well as to start automatically the flow as desired.

Additional chuck spindles are available for external threading.

Thread-cutting Screws

. . . eliminate tapping operation normally required in use of standard machine screws.

Development of a screw that cuts its own thread in metals and plastics of virtually any thickness has been announced by the Shakeproof Lock Washer Co., Chicago. A patented, thread-cutting slot, plus a special hardening process, eliminates the tapping operation normally required in the use of standard machine screws.

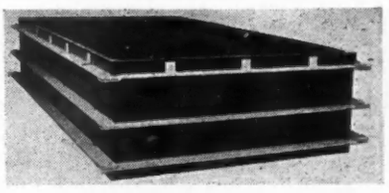
As stated by the manufacturer, production savings in both labor costs and time are assured by the use of this fastening method and, because the screw remains in the threads it has cut, a better fastening results. Another advantage reported is the fact that, should it be necessary to replace the screw, an ordinary machine screw of the same size will fit its threads.

Pickling Tanks

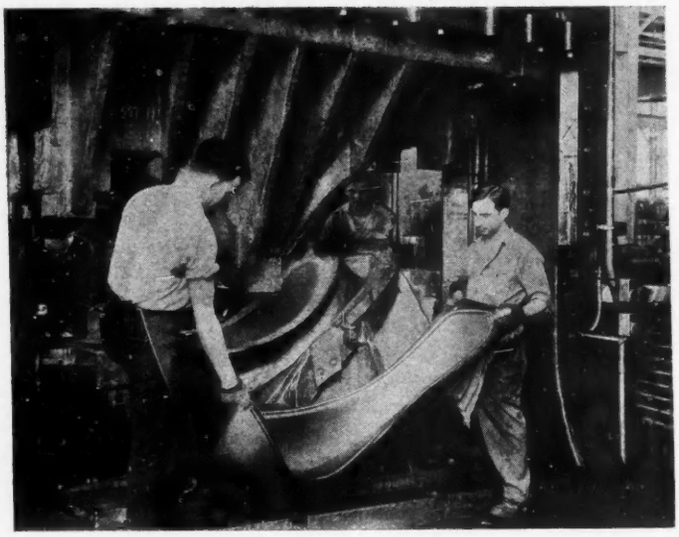
. . . molding process facilitates construction with length, width and depth in multiples of 6 in.

The Continental Diamond Fibre Co., Newark, Del., recently adopted a molding process which permits construction of its Haveg pickling tanks with length, width and depth in multiples of 6 in. One piece seamless construction is used for tanks up to about 9 ft. 6 in. long, 6 ft. wide and 6 ft. deep. Tanks may also be made up to 12 ft. long with proportionate reduction in cross section diameters.

Haveg tanks are molded plastic products and are useful for the pickling and plating of all types of metal parts. They are made by combining acid resisting asbestos fibre with a phenolic type resin. In addition to acid resistance, these tanks are said to be unaffected by rapid temperature changes and suitable for operating continuously at temperatures up to 265 deg. Fahr.



Haveg tank for pickling and plating metal parts.



Production Lines

The new fender line at De Soto heads the long list of improvements in the press plant. Workmen are shown removing a fender from the huge double-crank toggle drawing press which weighs almost 400,000 pounds and is capable of 1,000,000 pounds of pressure on the plunger. This press measures 132 inches between uprights and is 90 inches deep from front to back.

To Stabilization

Olds has done something that, to us, represents one of the most practical approaches to the sorely-needed solution of the problem of work stabilization. The whole industry has gone a long way to employment stability in the past few years, more specifically since the Show date was moved into the fall season of the model year. Now, under McCuen's leadership, Olds has taken the next step. We refer to the magnificent storage plant which sprang up literally overnight on the site of what used to be a parking lot. Its chief purpose is to provide ample space for storing vital parts of the car. This will be done not only to safeguard production schedules but to store units which may be produced during otherwise slack periods. Thus it will be possible to keep men at work even at times when the assembly lines may be down.

Metal Shifts

What has the "war" in China got to do with the automobile business? Well for one thing it has affected the production and shipment of certain raw materials that are characteristically Chinese. One of the important export items of raw materials is the tungsten used for high-speed-steel cutting tools, for the sintered carbide tool tips, and for other types of alloy materials. We understand that for many purposes, molybdenum is being substituted for tungsten, thereby justifying the claims made some years ago when the "Momax" high-speed-steel was introduced. You will recall they said that the new cutting tool would be a most welcome and essential product when an emergency affected the availability of tungsten. So far as the cemented-carbides are concerned, a recent note from Carboloy indicates that there is sufficient supply of tungsten available from other sources to assure continued production. And they felt that even the price structure could be maintained despite the higher cost of tungsten from other sources of supply.

Transmission Shifts

Judging by what we hear at the Previews in talking to the automobile editors who are not technical but certainly more technically minded than car owners, there is a BIG job to be done in differentiating between the various remote controls. Here is the setting—three makes of cars will have the Evans combination vacuum power and mechanical linkage shift; two G.M. cars will have a straight mechanical control from a hand lever under the steering wheel; two other G.M. cars—Buick and Olds—will have the automatic transmission. To the car owner and, indeed, to any non-technical observer, they all feature the same kind of hand lever control, regardless of its location and at least one well-informed newspaper editor had the idea that they were all alike. What will the public think? Here's a fine opportunity for the publicity departments to do their stuff.

Safety Tread

At least one car builder is featuring the fact that the front tires on their knee-action cars will have a ribbed tread. Reason—lower noise level with the knee-action front. However, we have just learned confidentially that a prominent and impartial research organization has just completed a long series of tire skid tests which indicate that the ribbed tread has better traction qualities under all kinds of road conditions. If this is true, then the car builders who use the ribbed tread have much more of a story for their owners, since this type of tire offers safety with a capital S.

Precise Balance

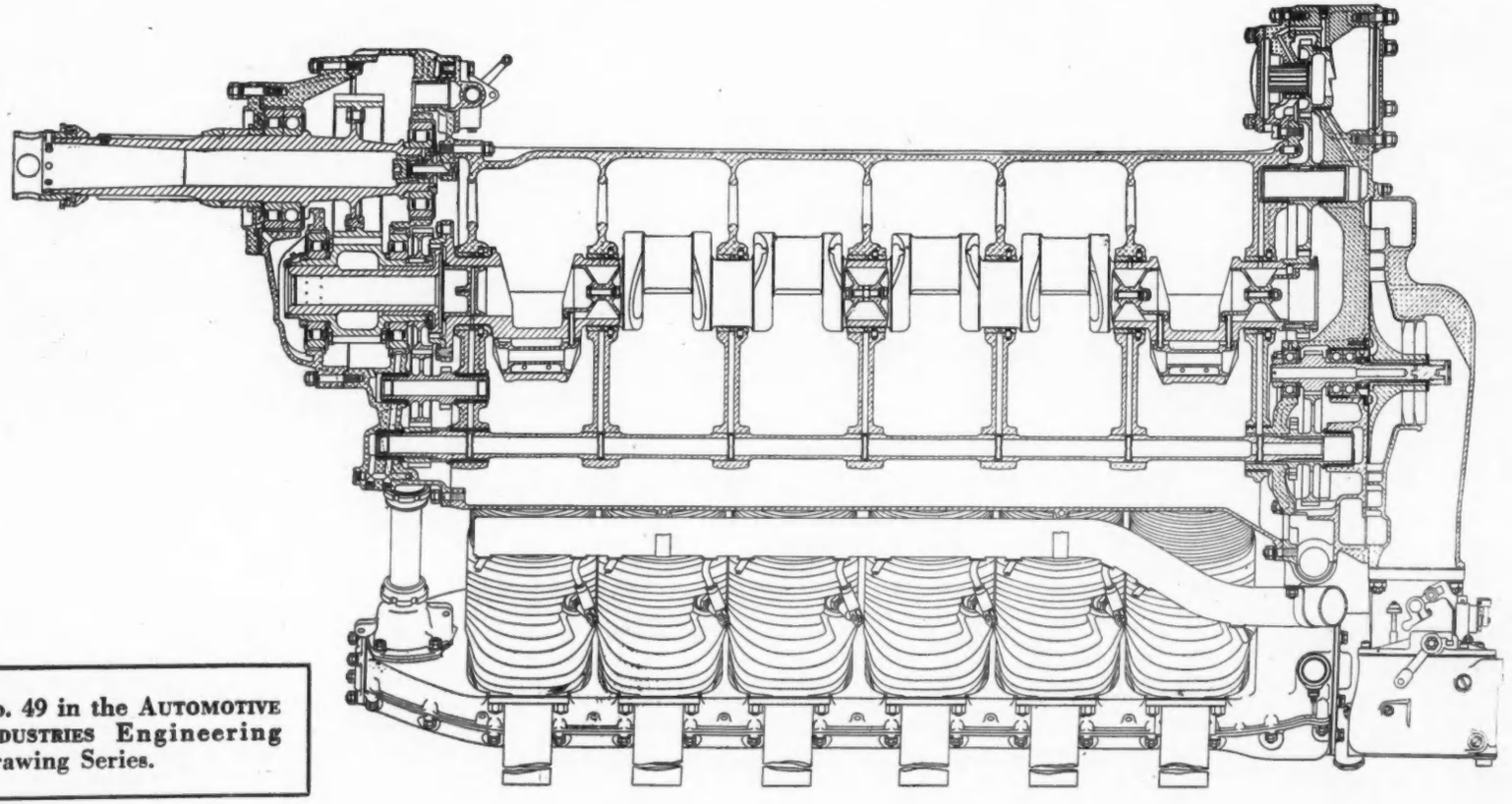
The smoothness of the modern car resides in hidden features that are not obvious to the observer. And one of the most important elements is that of balance of all reciprocating parts. Precision balancing has come a long way as a normal mass-production operation as you will appreciate by casting your eye on the following list of Pontiac specifications for balance—

Crankshaft and flywheel	½ in. oz.
Crankshaft balancer assembly	½ in. oz.
Clutch	½ in. oz.
Con rod	1/16 oz. (tol.)
Piston	1/16 oz. (tol.)
Universal joint and propeller shaft	⅜ in. oz. at 2200 r.p.m.

Endurance Plus

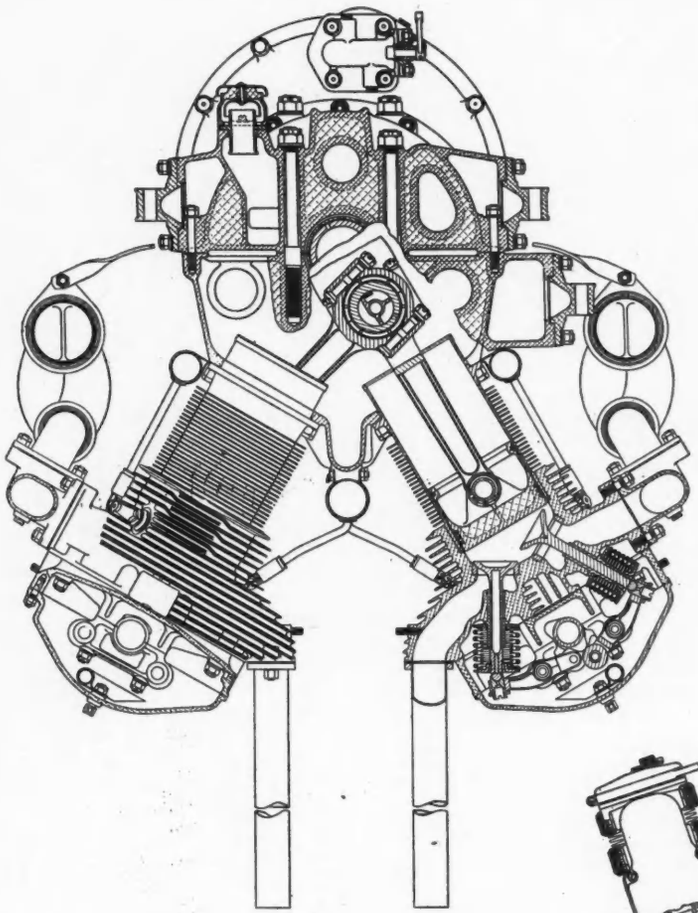
One of the neatest tricks of the year is a process developed for increasing the endurance limit of service axle shafts where it is impractical to increase their effective diameter. It might also do as a regular production procedure if one were so minded. The trick is to shot-blast the critical sections of the shaft with very fine shot. The effect of the treatment is to produce a very uniform surface condition which is most favorable in torsional stress.—J. G.

RANGER . . . . *12-cylinder inverted V, geared, supercharged aircraft engine manufactured by the Ranger Engineering Corporation.*

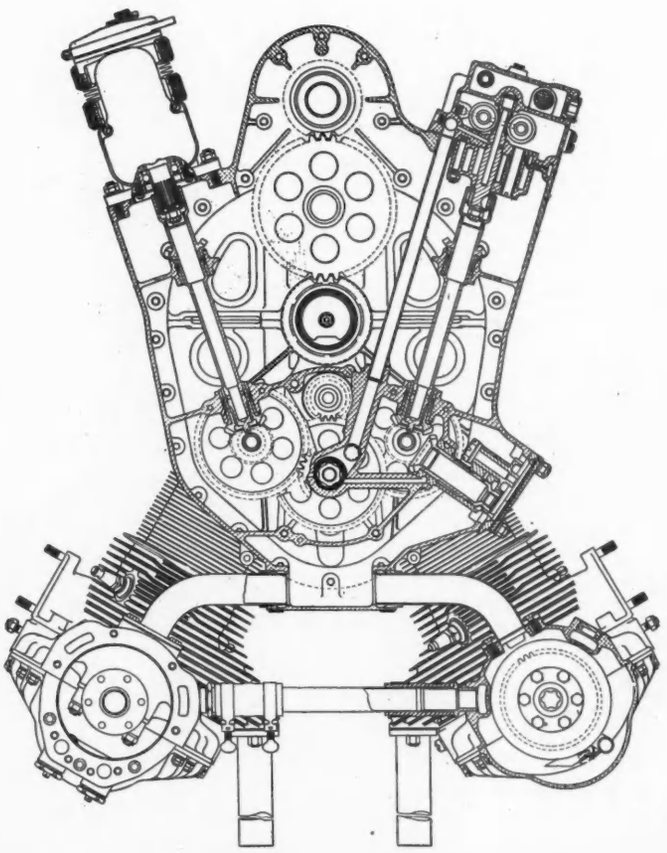


No. 49 in the AUTOMOTIVE INDUSTRIES Engineering Drawing Series.

RANGER



a manifold pressure of 39.5 in. of mercury. The cruising horse power is 320 at 2550 r.p.m. Fuel consumption under cruising conditions, as the carburetor setting is varied from lean to full rich, varies between 0.50 and 0.58 lb. per hp.-hr. In the dry condition the weight of the engine ranges between 630 and 640 lb.



This engine, which has its two banks of cylinders set at an angle of 60 deg., has 4- by 5⅛-in. cylinders with a total piston displacement of 772.8 cu. in. With a compression ratio of 6, a blower-to-crankshaft ratio of 8.84 and a crankshaft-to-propeller ratio of 3.2, the engine develops 420 hp. at 2800 r.p.m., at an altitude of 3000 ft. with

Paraffin Hydrocarbons Isolated from Crude

(Continued from page 486)

packed with locket chain and having an efficiency of about 60 plates, and were purified by low-temperature crystallization.

In measuring the physical properties, care was taken to obtain the highest accuracy on materials of high purity. The properties measured included in most cases the boiling point, freezing point, density, refractive index, American Society for Testing Materials' octane number, the coefficients of variations of refractive index and density with temperature, and the coefficient of variation of boiling point with pressure.

This work is more fully reported in the September number of the Journal of Research (RP1027).

More Russian Cars

ACCORDING to the Moscow publication "For Tractors and Motor Vehicles," the total production of the Soviet industry during 1936 amounted to 137,000 motor vehicles and 97,000 tractors in round figures, 29,000 of the tractors being of the chain-track type. In addition there were produced some 70,000 automobile and tractor engines which together with replacement parts represented a value of 560 million rubles. As compared with 1935 the production of tractors decreased 3.7 per cent, which is said to be due to the fact that the tractor plants in Charkoff and Stalingrad were re-equipped for the production of crawler-type tractors and consequently had to curtail the production of wheeled tractors. The mean production per worker in the automobile and tractor industry rose from 22,000 rubles in 1935 to 25,000 in 1936.

Better Industrial Lighting

IN a paper dealing with the neglect of lighting installations, Samuel G. Hibben, Director of Applied Lighting, Westinghouse Lamp Division, Bloomfield, N. J., calls attention to the losses resulting from neglect of lamps and lighting fixtures. The direct causes of loss may be classified as follows:

1. Dirty lamps and accessories
2. Darkened or discolored walls and ceilings
3. Lamp bulbs of poor quality or low efficiency
4. Empty sockets and unobserved burnouts
5. Aged lamps past their prime of usefulness.
6. Undervoltage burning of lamps
7. Improper combination of lamp and reflector

The importance of removing films of dirt and grease from the lighting units is clearly brought out by the following practical example. A Glassteel Diffuser in a somewhat smoky machine shop when new produced more than 12 foot-candles of illumination on the work bench beneath. It had gradually gotten dirty during weeks of neglect so that the illumination had come down to 3 foot-candles, which, of course, meant that the unit cost of the illumination actually produced had quadrupled. It meant that out of every dollar spent for electric power and lamp bulbs, 75 cents were being wasted. In another case a large office building was equipped with lighting units consisting of semi-indirect bowls which from the floor appeared to be perfectly clean, yet when the bowls were removed, washed thoroughly, and replaced, the illumination increased from 1.8 to 2.4 foot-candles, an increase of 33 per cent.

◆ BUYERS' GUIDE ◆

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Atlas Drop Forge Co.

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Hyatt Bearing Division General Motors Corp.

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Greenlee Bros. & Co.
Heald Machine Co.

Brake Strand
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See Alphabetical List of Advertisers on pages 42 and 43

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Anaconda Wire & Cable Co.

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(Turn to page 38, please)